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The Aerospace Capability Framework

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A guide to transform and develop Canada's Air Force

Canada



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The Aerospace Capability Framework



Foreword

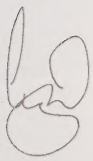
As part of the Canadian Forces, the Air Force is responsible – along with the Army and Navy – for defending Canada and Canadian interests and values, while contributing to international peace and security. As members of the Profession of Arms, Air Force personnel are responsible for the stewardship and development of aerospace power and the generation of air capabilities required by the Canadian Forces as a whole.

The goal of the Air Force is to provide the Government of Canada with an effective instrument of national power. Our vision is an Air Force based on excellence and professionalism, equipped, trained and ready to prevail in combat, with the reach and power to effectively contribute to national and international security.

To assist in achieving and communicating the vision, the Air Force has created several new documents. From a planning perspective, the two most comprehensive of these are:

- Strategic Vectors, which articulates the Air Force vision at a strategic level. The contents of Strategic Vectors are derived from the more detailed Aerospace Capability Framework; and
- The Aerospace Capability Framework, the Air Force's main strategic planning document. The goal of the ACF is to guide the evolutionary transformation of the Air Force by ensuring we:
  - — blend existing and emerging systems and structures;
  - — capitalize on the fundamental advantages of aerospace power, namely responsiveness, speed, reach, combat power and manoeuvrability; and
  - — leverage new technologies as well as a highly educated, informed and ethical membership to create significant operational enhancements.

While Strategic Vectors and the Aerospace Capability Framework are consistent with current defence policy and Strategy 2020, both will need updating to reflect changes as they may occur. In particular, the Air Force will pay close attention to developments with Strategy 2025 as well as the evolving Canadian Forces Strategic Operating Concept and make changes accordingly.



L. C. Campbell

Chief of the Air Staff / Commander Air Command

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Chapter One

Aerospace Power *and* Capability







Aim

The aim of the ***Aerospace Capability Framework (ACF)*** is to articulate a clear strategic vision to guide the transformation and development of Canada's Air Force over the near and mid term.

Strategy 2020 Vision

The vision and main themes of the ACF are consistent with those outlined in Defence Strategy 2020:

> ***"The Defence Team will generate, employ and sustain high-quality, combat-capable, inter-operable and rapidly deployable task-tailored forces. We will exploit leading-edge doctrine and technologies to accomplish our domestic and international roles in the battlespace of the 21st Century and be recognized, both at home and abroad, as an innovative, relevant, knowledge-based institution. With transformational leadership and coherent management, we will build upon our proud heritage in pursuit of clear objectives."***

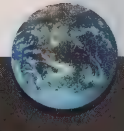
Overview

The ACF contains five chapters. The first discusses aerospace power and aerospace capability and how these are generated by air forces. The second discusses Canada's Air Force and the capability it maintains. The third briefly discusses late 20th Century Air Force evolution, plus current Air Force problems and shortfalls. The fourth presents a strategic vision as well as a strategy to transform the Air Force into a more capable, credible and relevant force, one that can be sustained into the future. The final chapter presents an outline of the projects, initiatives and studies underway or necessary to effect transformation.

ACF Linkage

As a planning document, the Aerospace Capability Framework exists within a hierarchy of documents that includes:

- **Canada's Air Force – A Vital National Security Institution** – a strategic document that explains how the Air Force contributes to the security of Canada and Canadians and to the projection of Canadian values and peace and security interests abroad;



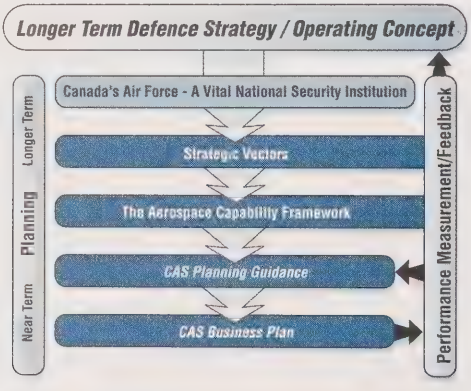
- **Strategic Vectors** – an Air Force strategy document created to articulate a clear, strategic vision over the near, mid and longer-term in response to the 21st Century security environment;

- **The Aerospace Capability Framework (ACF)** – an Air Force strategic planning document containing implementation details for the Air Force vision and strategy over the near and mid-term;

- **CAS Planning Guidance (PG)** – an Air Force strategic direction document that provides guidance to subordinate units and staffs over a five-year period. The ACF is a source from which CAS PG is prepared; and

- **CAS Business Plan** – an Air Force strategic resource document that allocates resources over the short term. CAS PG is expressed in the CAS Business Plan.

The following illustration shows the general relationship of the above-mentioned documents.



Definitions

Aerospace

Doctrinally, the term aerospace means air and space. It is used to define the environment that surrounds the Earth and extends vertically into space from the Earth's surface. The term 'aerospace' takes on added meaning within the ACF, since it also underscores the increasingly important role that space will play in future military operations.



U.S. Airforce Photo

...we will build upon our proud heritage in pursuit of clear objectives.

Aerospace Power

Aerospace power is defined as that component of military power that is applied within or from the aerospace environment to achieve effects above, on and below the surface of the Earth.

Over time, aerospace power has evolved from being an adjunct of land and sea power to constituting an important and inherently flexible power in its own right. While it retains the capability to substantially influence land and maritime warfare through contributing operations, it is also capable of being effectively applied, either sequentially or simultaneously, through independent and integrated operations.

Aerospace Platforms

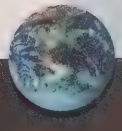
Aerospace power is derived from the use of platforms that exploit the aerospace environment for military purposes. While it is expected that aerospace platforms will be capable of operating throughout the aerospace environment in the years ahead, current platforms are categorized as:

- *Exo-atmospheric* – spacecraft and satellites;
- *Trans-atmospheric* – ballistic missiles; or
- *Atmospheric* – fixed and rotary wing aircraft (piloted, remotely-piloted or unmanned) and cruise missiles. Fixed wing aircraft, more commonly referred to as aircraft, also referred to as 'air' assets. Rotary wing aircraft, more commonly referred to as helicopters, are also referred to as 'aviation' assets.

Aerospace Power Components

There are four key components that make up aerospace power: people; platforms; supporting equipment; and infrastructure.

- People are the foundation upon which aerospace power is generated and employed. While high-technology equipment is important, if such equipment is to be used with effect, it must be operated and supported by intelligent, highly motivated and well-trained personnel.
- Platforms are the vehicles through which aerospace power achieves effect. Aerospace platforms have inherent advantages of speed, reach and maneuverability in comparison with platforms that operate on the surface or sub-surface. Greater mobility combined with greater speed allows faster response times – and faster responsiveness allows aerospace power to better dominate the fourth dimension, time.



- Equipment includes weapons, sensors and other systems required to generate, employ, support and sustain aerospace power.
- Infrastructure must be available to support operations and house the people, equipment and materiel required for force generation and force employment.

Air Force Operational Advantages, Roles and Functions

Operational Advantages

The aerospace environment and capabilities inherent in aerospace platforms offer key operational advantages. These advantages allow air forces to:

- Carry out operations having a significant impact on all three levels of conflict – strategic, operational and tactical – at the same time.
- Rapidly deploy to or withdraw from operational theatres.
- Strike quickly and directly at an adversary's center of gravity, over long distances and with few restrictions based on geography.
- Apply power directly or indirectly to help shape and respond to events.
- Produce powerful, visible and effective results for relatively low employment costs.
- Operate with a minimum footprint, reducing exposure to hostile action and limiting the potential for casualties, *and*
- Remain forward-based and therefore capable of immediate offensive action for relatively long periods of time.

Infrastructure must be available to support operations and house the people...

Air Force Roles



A ***role*** is defined as "what a person or thing is appointed or expected to do". The fundamental and most demanding role for air forces is to generate, apply and sustain aerospace power in combat operations: domestically, in defence of the nation; or abroad, alongside allies or coalition partners. The security roles assigned to air forces around the world include air sovereignty at the lower end of the conflict spectrum to high intensity combat at the upper end. Air forces can be expected to perform roles grouped in the following areas:

- ***Safeguard Sovereignty*** – by actively controlling unwanted or unauthorized airborne activities in national airspace. Air forces can also contribute to safeguarding maritime and territorial sovereignty through means such as airborne surface or sub-surface surveillance.

- ***Defend the nation*** – by conducting operations either independently or jointly with other Services.

- ***Protect the citizens of the nation*** – by carrying out Search and Rescue operations, evacuating nationals from areas of conflict overseas, contributing to disaster relief efforts, deterring and responding to terrorist attacks or providing aid to the civil authorities.

- ***Protect the resources of the nation*** – by contributing to domestic security operations such as fisheries patrols, aerial drug interdiction and environmental monitoring.

- ***Project Power abroad*** – by carrying out operations that involve the application or threat of force.

- ***Protect Interests abroad*** – by contributing to international operations such as peace support or humanitarian assistance.

Air Force Functions

A ***function*** is defined as "activity proper to a person or institution...activity by which a thing fulfils its purpose". An air force fulfils its purpose through operations and missions grouped in the following four areas:

- ***Fundamental Functions*** – operations conducted to achieve freedom of action in the aerospace environment; or those in which aerospace forces are the primary means of applying force against an adversary's centre of gravity to achieve desired strategic effects. While these functions can be executed as part of a combined or joint campaign, they are fundamentally air force in nature and comprise the following operations:

  - *Aerospace Control*
    - — Offensive Counter Air (OCA)
    - — Defensive Counter Air (DCA)

  - *Aerospace Force Application*
    - — Strategic Attack

- ***Contributing Functions*** – operations that contribute to the achievement of objectives of other services or organizations. Such operations include:

  - *Aerospace Operations Against Surface and Sub-Surface forces*
    - — Counter-Sea
    - — Counter-Land

  - *Aerospace Operations that stem from National Interests*
    - — Domestic Operations that protect citizens
    - — Domestic Operations that protect national resources
    - — International Operations that protect interests

...these functions can be executed as part of a combined or joint campaign.

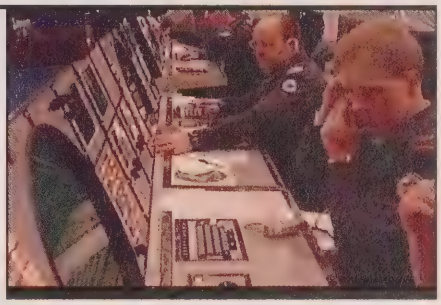
- ***Enabling Functions*** – aerospace operations that enable the preceding operations to be effectively executed across the spectrum of conflict.

- ***Support Functions*** – non-flying activity essential to conducting the flying operations discussed above.

Aerospace Competencies

Competency is defined as "ability to do". In this regard, competencies are abilities that enable air force functions to be undertaken. A *core* competency is an ability that is fundamental to the effective prosecution of air force operations and missions.

Fundamental Air Force Functions



Aerospace Control

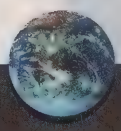
Aerospace Control is a primary operational function of air forces. For an air force to possess this capability, it must be capable of conducting both surveillance and control. Surveillance means having the ability to exploit the aerospace environment to acquire the situation awareness (SA) required to know when unauthorized or unwanted activity is taking place. Control means having the ability to actively respond to and control (and potentially eliminate) unauthorized or unwanted activity.

In peacetime, the aerospace control capability of an air force is used to safeguard sovereignty. In times of tension, it is used to control access to specific airspace (through enforcement of 'no fly' zones, for example). In conflict, it is used to achieve air superiority, to enable freedom of action in the aerospace environment (and on the surface for friendly forces), and to deny such freedom to adversaries.

Offensive Counter Air (OCA) operations are those conducted to limit, disrupt or destroy an adversary's aerospace power as close to its source as possible through the following missions:

- *Surface Attack (SA)* – to target the source of an adversary's aerospace power, including warning and control facilities and aerospace base and launch facilities;
- *Suppression of Enemy Air Defence (SEAD)* – to target an adversary's aerospace defence systems; *and*
- *Sweep (SWP)* – to target adversary aircraft or targets of opportunity in an allocated area of operations.

Defensive Counter Air (DCA) operations are those conducted to neutralize opposing aerospace forces that threaten friendly forces and/or installations through the following missions:



- *Combat Air Patrol (CAP)* – to defend (point, barrier, lane or area) friendly surface-based forces against attack by opposing aerospace forces;
- *Escort (ESC)* – to defend airborne friendly forces against attack by opposing airborne forces; *and*
- *Air Intercept (AI)* – to intercept opposing aerospace forces conducted from alert facilities, airborne CAP, or diverted from other missions.

For aerospace control, core *decision-making* competencies include capabilities to detect, validate, assess, characterize and respond to unwanted activities in the aerospace environment. Core *surveillance* competencies include capabilities to detect, track, catalogue and monitor the aerospace environment with an Air Moving Target Identification (AMTI) capability. Core *control* competencies include capabilities to execute the AI, ESC, CAP, SWP, CSA and SEAD missions discussed above.

Aerospace Force Application



Aerospace Force Application is also a primary operational function of an air force. Force application is the primary means of applying force against an adversary's centre of gravity to achieve desired strategic effects. This capability can also be used for coercive presence.

In combat, strategic attack missions aim to progressively destroy and disintegrate an adversary's capacity or will to wage war. Such missions are normally conducted against the adversary's centre of gravity (COG) or against a selected series of vital targets leading to the COG. Attacks against such targets would be expected to produce strategic effects well beyond the proportion of effort expended. Vital targets can include targets in the leadership, industry, transportation, communication or armed forces categories.

Core *decision-making competencies* include capabilities to identify targets, formulate prioritized lists, establish target damage objectives, perform weapon to target and aircraft to weapon matching and confirm appropriate target designation and attack. Core *C4ISR competencies* include the detection and correct identification of targets. They also include the monitoring of airborne attack using air and surface surveillance sensors and systems with Ground Moving Target Identification (GMTI) capabilities, and bomb damage assessment (BDA) performed after attack (to include dissemination of the information gained by a weapons effect analysis to either confirm the attainment of the objectives or the need to re-attack). Core *operational competencies* include the capability to effectively execute strategic attack missions during the day and at night in bad weather and in a hostile IADS environment.

Contributing Air Force Functions



Air and aviation assets can contribute indirectly and directly to the military operations of other services. Indirect contributions involve forces that are not in direct contact with opposing forces. Direct contributions involve forces that are in direct contact with opposing forces.

Indirect Counter-Land operations

Indirect Counter-Land air operations involve aircraft performing air interdiction missions that aim to destroy, neutralize or delay an adversary's military potential before it can be brought to bear effectively against friendly forces. They can be effective against follow on forces, equipment and supplies. They can reduce an adversary's capability to mount an offensive, restrict an adversary's freedom of action, prevent an adversary from countering an increase in friendly strength, or reduce battlefield reserves.

Indirect Counter-Sea operations

Indirect Counter-Sea air operations involve aircraft tasked into a geographically defined operating area to conduct either Anti-Submarine Warfare (ASW) or Anti-Surface Warfare (ASUW) operations. ASW operations involve missions to detect, locate, track and attack submarines. ASUW operations involves missions to search for, identify, shadow and attack surface vessels.

Direct Counter-Land operations

Direct Counter-Land operations involve:

- Aviation assets performing the following types of missions:
  - — *Combat Power* – application of force, surveillance and the reconnaissance of terrain, weather and disposition of adversary forces
  - — *Combat Support* – communications assistance and the direction and control of fires
  - — *Combat Service Support* – airlift of personnel, equipment and supplies
- Air or aviation assets performing Close Air Support (CAS) missions that aim to halt attacks, help create breakthroughs, cover and guard flank of Army forces. They produce brief, but focused effects on adversary land forces that may be necessary to ensure the success or survival of friendly forces.

Direct Counter-Sea operations

Direct Counter-Sea operations involve:

- Aviation assets performing the following types of missions:
  - — Anti-Submarine Warfare (ASW)
  - — Anti-Surface Warfare (ASuW)
  - — Airlift of personnel, equipment and supplies
- Air assets performing the following types of missions:
  - — Anti-Submarine Warfare (ASW)
  - — Anti-Surface Warfare (ASuW)
  - — Anti-Air Warfare (AAW)

Contributions to Operations that stem from National Interests



Air forces can also contribute to a variety of other operations of importance to the nation through missions such as:

- **Domestic and International Operations that Protect Citizens**
  - — *Domestic Search and Rescue (SAR)*
  - — *Terrorism Response*
  - — *Aid of the Civil Power*
  - — *Disaster Relief*
  - — *Protection and Evacuation of Canadians Overseas*
- **Domestic Operations that Protect National Resources**
  - — *Fisheries Protection*
  - — *Drug Interdiction*
  - — *Environmental Monitoring*
- **International Operations that Protect Interests**
  - — *Peace Support (UN Chapter 6/7)*
  - — *International Humanitarian Assistance*

Enabling Functions



Enabling functions span a wide range of operational activities necessary to conduct effective aerospace operations. The following areas are some of the most important:

- Airlift
- Air-to-Air Refueling (AAR)
- Combat Search and Rescue (CSAR)
- Electronic Warfare (EW)
- Airborne Early Warning (AEW)
- Airborne Command and Control (AC2)
- Intelligence, Surveillance and Reconnaissance (ISR)
- Special Operations

Often, specialized platforms are required to conduct enabling operations. Airborne Command, Control and Communications (ABCCC), Joint Surveillance Target Attack Radar System (JSTARS) and Airborne Warning and Control System (AWACS) aircraft are among those commonly used. Lesser known platforms include special operations aircraft (for example, 'Spectre and Spooky' Gunships, Combat Talon, Combat Shadow, Pave Low and Commando Solo). The term "High Demand-Low Density (HDLD)" is a term sometimes used to denote such platforms, indicating demand normally exceeds supply of these important enablers.

The Operating Environment

The missions discussed above can be executed during the day, at night and in a variety of weather conditions. As well, those missions involving combat can be threatened by Integrated Air Defence Systems (IADS) composed of Anti-Aircraft Artillery (AAA), Surface-to-Air Missiles (SAM) and/or adversary fighter interceptor aircraft. Aircraft must be outfitted with, and crews trained to handle, systems to effectively operate and survive in such environments.

Support Functions

Many different activities must be undertaken to support and sustain the operations discussed above. These include:

- *Aircraft support:*
  - — Aerospace Engineering Program Management (AEPM)
  - — Aircraft Battle Damage Repair (ABDR)

- *Flying operations support:*
  - — Environmental (meteorological and oceanographic)
  - — Intelligence
  - — Command Post (CP) and operations centre
  - — Air Traffic Control (ATC)
  - — Ground Control Intercept (GCI)
  - — Air-Ground-Air (AGA) communications.

- *Airfield force protection:*
  - — Airfield Defence Force (ADF)
  - — Airfield Security Force (ASF)

- *Airfield force reconstitution and survival to operate:*
  - — Chemical Biological Radiological Nuclear or high yield Explosive (CBRNE) response capability
  - — Airfield Engineering and Support (AES)
  - — Damage Definition and Assessment (DDA)
  - — Explosive Ordnance Disposal (EOD)
  - — Repair of Runway Surfaces (RRS)
  - — Essential Services Repair (ESR)
  - — Crash Fire Rescue (CFR) and arrestor gear activities

- *Logistics technical services support:*
  - — Construction Engineering (CE)
  - — Material and Distribution Services (Electro-Mechanical Engineering (EME), supply, and transport)
  - — Telecommunications
  - — Food services

- *Logistics administration and financial support:*
  - — Financial
  - — Personnel
  - — Medical
  - — Dental

- *Space support*
  - — Systems to deliver satellites, payloads and material into or through space
  - — Capabilities to maneuver, configure and sustain on-orbit satellites and to activate on-orbit spares using telemetry, tracking and command systems.
  - — Capabilities to de-orbit and recover satellites.

Categorization of Air Forces

General

Air forces can be grouped into one of three categories according to the responsibilities assigned to them by their governments:

- ***National*** air forces are those whose focus is primarily domestic, with responsibilities for such missions as air sovereignty, air defence, SAR, etc.
- ***Regional*** air forces are those that, in addition to domestic roles, have responsibilities of a regional nature, deriving from either collective security arrangements or broader national interests.
- ***Global*** air forces are those that, in addition to domestic and regional responsibilities, are expected by their governments to participate in operations on a global basis.

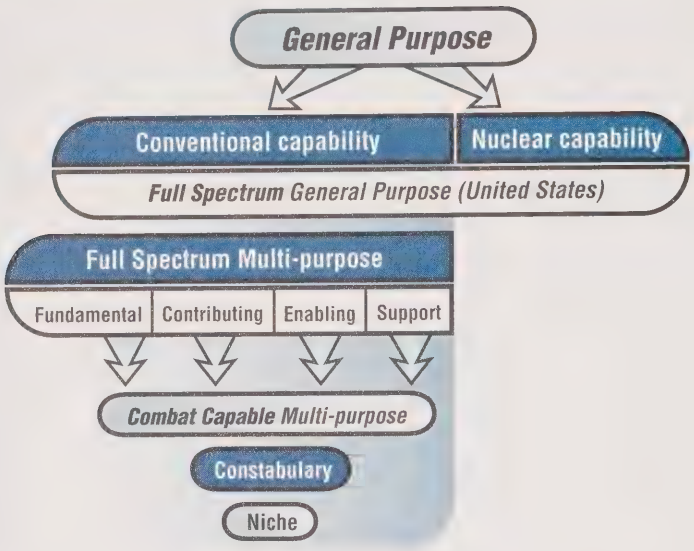
Impact of Collective Arrangements

Responsibilities assigned to regional and global air forces that stem from collective security arrangements normally come with both benefits and costs. On the positive side, collective security arrangements can facilitate the sharing of regional and international security responsibilities, thus increasing overall capacity or reducing costs to the various partners. The corollary is that membership in collective security arrangements may also generate requirements for capabilities beyond those required for purely national purposes.

Breadth of Capability

In the past, the term *balanced* was frequently used to describe an air force possessing the entire breadth of aerospace power capability. Today, the term used for such an air force is *full spectrum*. The chart below graphically displays the levels of capability found in contemporary air forces.





- Full spectrum general-purpose air forces are those possessing a nuclear capability plus conventional capabilities useable across the entire spectrum of conflict. The United States has such an air force.
- Full spectrum multi-purpose air forces are as described above but without the nuclear capability.
- Combat capable multi-purpose air forces are those able to perform, as a minimum, fundamental aerospace operations across the spectrum of conflict. Generally such forces also possess at least some capabilities in other areas (contributing, enabling and support).
- Constabulary air forces are air forces designed to carry out 'law and order' type missions such as those to counter aerial drug smuggling. Such air forces are not combat capable.
- Niche air forces are air forces that maintain specific capabilities for very specific purposes. They have little or no flexibility to respond to events across the spectrum of conflict.

It is clear that combat capable forces possess greater flexibility...

Flexibility of Combat Capable Forces

In terms of conventional air forces, it is clear that combat capable forces possess greater flexibility than either constabulary or niche air forces. Aircraft and other aerospace platforms acquired for combat can generally be used for peacetime operations. The same holds true for personnel: properly trained, combat capable personnel can almost always carry out lower intensity operations effectively. On the other hand, equipment purchased for non-combat uses or crews not trained for combat operations are of little value on the battlefield; indeed, employing such forces in combat could be seen as dangerous, unethical and potentially costly in terms of human life.

The flexibility associated with combat capable equipment generally comes at a premium and, once acquired, such equipment must be kept modernized to remain useful. Combat skills are perishable and must be practiced on a regular basis; if lost, combat skills normally take considerable time, effort and resources to regain.

In short, if a nation wishes to maintain the flexibility required to react to an unpredictable world, appropriate investments must be made in both equipment and training.

Depth of Capability

The depth of an air force's capability is determined by quantitative measures such as numbers of people, numbers of aircraft, stockpiles of ammunition and so on. While depth does not of itself determine quality, it directly affects the ability of an air force to sustain operations over a period of time. Depth (or more precisely, a lack of depth) may also impact critical mass, an important concept discussed next.

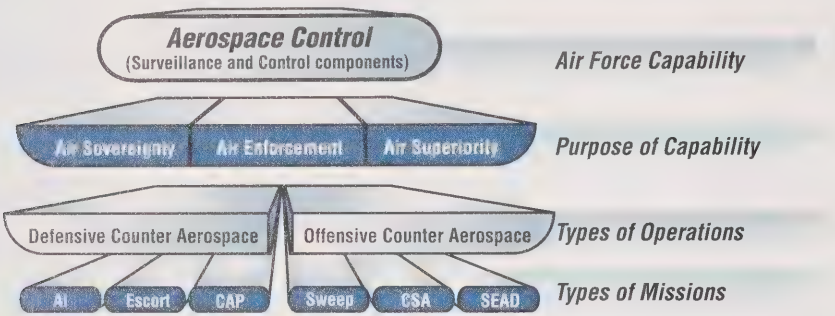
Critical Mass

Critical mass refers to the smallest size an aerospace capability can be (measured in people and platforms) while still remaining operationally viable. *Above* critical mass, an air force should be capable of maintaining capability and readiness at assigned levels while carrying out all assigned missions. At critical mass, an air force will likely be capable of carrying out the training required to maintain minimum levels of readiness and only executing essential tasks. *Below* critical mass, aerospace capabilities will not be self-sustainable. This does not mean operational capacity does not exist; but it does mean that, if operations are undertaken, force generation will be degraded and capabilities will atrophy. While lost capabilities can be rebuilt, this often takes considerable time and (in most cases) the investment of substantial resources.

An Example of Capability

Having discussed some of the determinants of capability, this next section will attempt to show, by way of example, how the concepts and definitions relate to a specific capability, aerospace control.

To be effectively employed in operations, forces must possess both *capability* and *readiness*. Capability refers to having an ability to undertake a specific operation or mission for which appropriate training was provided. Readiness refers to the proficiency and preparedness required to deploy forces in a timely manner and to employ them effectively in operations.



Aerospace control is an example of an air force capability. For an air force to possess this capability, it must have the ability to carry out both *surveillance* and *control*. The surveillance component requires having the ability to determine when unauthorized or unwanted activity is taking place within a particular aerospace environment. A variety of surface, airborne and space-based sensors may be used to gather data for decision-makers to validate, assess, and characterize such activity. The control component of aerospace control means having the ability to actively respond to and control unauthorized or unwanted activity. Fighter aircraft are normally used to do this, but other more limited systems may also be used (surface-to-air missiles for example).

Aerospace control is planned and implemented using two basic types of operations: defensive counter air and offensive counter air. These operations are executed at the tactical level through six different missions: *Air Intercept* (AI), *Escort* and *Combat Air Patrol* (CAP) have defensive objectives; *Sweep, Conventional Surface Attack* (CSA) and *Suppression of Enemy Air Defences* (SEAD) have offensive objectives.

The Generation and Application of Aerospace Capabilities



The acquisition, generation and application of aerospace capability involve the generation of Mission Ready (MR) forces and aircraft capable and ready for employment in operations.

Generating forces to produce aerospace power is a complex activity, involving both force development and force readiness generation activities. These activities are described below.

Aerospace Force Development

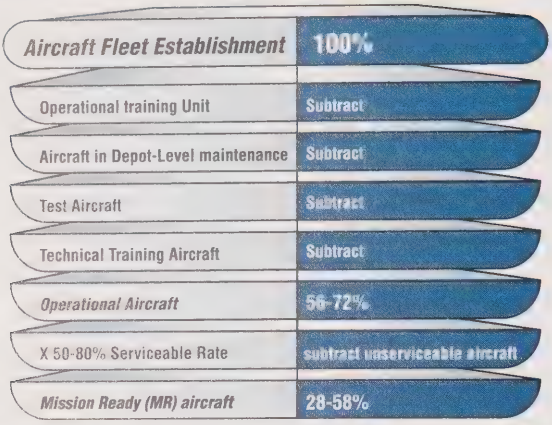
Aerospace force development embodies activities at the national level, aimed first at acquiring equipment, personnel and material; and then organizing these effectively to achieve the desired goal. Force development includes:

- Analyzing government policy to determine impacts on aerospace forces
- Determining required functional aerospace capabilities (based on policy analysis)
- Determining core competencies based on functional and mission requirements
- Formulating operational requirements for personnel, equipment and infrastructure
- Determining force structure requirements for organizations and personnel
- Developing concepts for the employment, maintenance and support of forces

Air Force Aircraft Fleet Composition

Aircraft fleets currently provide the primary means through which aerospace power is applied and such fleets also represent the largest equipment requirement for capital investment. Unfortunately, the factors associated with the acquisition and employment of such fleets are generally not well understood.

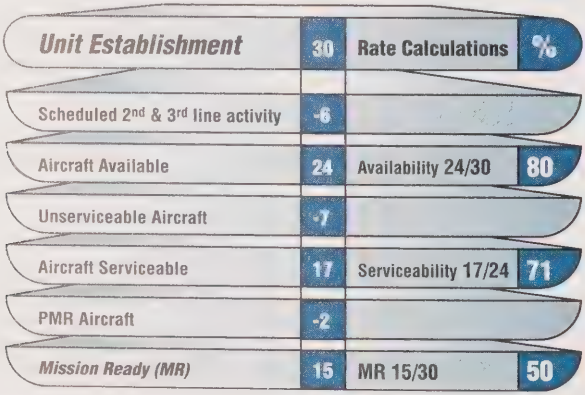
The total number of aircraft in a given fleet will always be larger than the number of MR aircraft available for operations as shown below. The range of numbers on the chart, while representational, is included for illustrative purposes only.



By way of example, with a fleet of 100 aircraft, if 20% are assigned to an Operational Training Unit (OTU), 15% are undergoing heavy maintenance, 5% are assigned to a test establishment and one aircraft (at any one time) is used for technical training, 59 aircraft would be available for assignment to operational units. Given a serviceability rate of 70%, the number of MR aircraft would be 42. The number of MR aircraft would be further reduced if aircraft were removed from the fleet for other reasons such as a major modernization or fatigue life management. The key point to be made here is that it is the number of *MR aircraft* in a particular fleet that is important, not the total fleet size.

Squadron or Wing Aircraft Unit Establishment (UE)

The concept explained above also applies to tactical-level air force formations such as squadrons and wings. The chart below attempts to graphically portray the situation on a hypothetical squadron with 30 aircraft assigned to its Unit Establishment (UE). It also introduces the concept of partially MR (PMR), aircraft that are serviceable but not equipped or configured to carry out all aspects of a specific mission.



Aircraft availability rate is the number of aircraft available to the unit from within those assigned to its UE. Due to 2nd and 3rd line maintenance activities, the number of aircraft *available* will be always be less than the UE (unless aircraft are added from reserves to compensate). In the previous diagram, 24 aircraft are available from the 30 assigned giving an aircraft availability rate of 80%.

Aircraft serviceability rate is the number of aircraft serviceable from within those available. In this example, there are 17 aircraft serviceable from within the 24 available. Aircraft awaiting test flight are not considered serviceable until successfully test flown. Aircraft serviceability rate is 71%.

Aircraft Mission Ready rate is the number of aircraft *serviceable* and mission ready from an operational perspective. Occasionally, aircraft may be considered serviceable to fly from an air maintenance perspective, but since they do not meet the requirements of a specific mission, are considered PMR. Such aircraft would be subtracted from the number of aircraft serviceable to obtain the number of MR aircraft. In this example, there are two PMR aircraft, so there are 15 that are MR. The MR rate, therefore, is 15/30 or 50%. MR rates are normally calculated at the start of each flying day.

Derivation of UE

The derivation of an Aircraft Unit Establishment (UE) is a complex process that varies according to aircraft type and mission assignment and which has a direct bearing on force readiness generation activity. The derivation of a fighter squadron's UE will be used to illustrate this important aspect of force development.

The smallest mutually supporting tactical fighting unit of the fighter force is a *section*, comprised of four aircraft. Individual squadrons are responsible for producing sufficient numbers of combat ready section leads to meet operational commitments. This requires sufficient numbers of aircraft and personnel to generate enough four-ship formations to accomplish section lead upgrade and currency training.

By way of example, the chart below indicates the overall force generation capability of three hypothetical fighter units – with UEs of 24, 18 and 12 aircraft (and 21, 15 and 10 available) respectively and based on a serviceability rate of 70% of those available.

Aircraft UE	24	18	12
Aircraft available	21	15	10
MR aircraft for 1st launch	14	10-11	7
MR aircraft for 2nd launch	10	7-8	5
MR aircraft for 3rd launch	7	6	3-4
Daily sortie generation	31	25	16

The ability of these squadrons to generate section lead training requiring eight aircraft (to conduct '4 versus 4' missions for example) varies significantly. A 24-UE squadron could do so during the first and second flying launches with relative ease. An 18-UE squadron would be challenged to do this for anything but the first launch. And a 12-UE squadron would likely be unable to do so at all. Of course, sorties generation would be even more difficult if a squadron also had operational commitments (air sovereignty alert, for example).

A variation of this concept can be applied to the air mobility community as well. For example, if a particular fleet's MR rate is 50%, approximately 16 lines of tasking can be generated with a 32 aircraft UE fleet (assuming other factors such as personnel do not constrain operations).

It is important to understand the aforementioned concepts to have a reasonable appreciation of aerospace force generation. Force development options, particularly required aircraft numbers, are highly dependent on an analysis of overall force generation and force employment requirements.

Aircraft numbers are important performance measures for force generation. Depending on the fleet, other measures may include:

- *Lines of Tasking (LoT) for air mobility*
- *Line crews for long-range patrol*
- *Section leads for fighters*
- *HELAIRDETS for maritime helicopters*
- *Flights for land aviation, and*
- *Alert response capability for SAR*

Personnel Establishments

Aircrews are required to fly air missions and therefore are an important consideration when personnel establishments are developed. Sufficient numbers of aircrews must be assigned to squadrons to meet both force generation and force employment requirements.

The required number of pilots – or for mixed crew units, the required number of crews – is generally expressed as *Pilot/Aircrew to Aircraft ratio* (PAA). Peacetime ratios should be based on the most demanding role of a particular squadron and allowances made for non-flying activities such as professional development, entitlements, administrative duties and non-flying supervisory functions.

At Wing level, more personnel are required to provide the air and ground support...

Many other personnel are required to generate, support and sustain air operations. For example, sufficient numbers of trained technicians must exist in order to generate the sorties necessary for training and operational mission execution. At Wing level, more personnel are required to provide the air and ground support necessary to operate and support all operations on the airfield and Wing. At higher headquarters levels, sufficient numbers of personnel are needed with the breadth and depth of experience and expertise to support force generation and force employment.

Overall, an air force's establishment must balance in three ways. There must be a sufficient number of personnel established to do the jobs assigned to the unit (resources must balance with tasks). There must be a sufficient number of personnel available to ensure balance between force generation and force employment activity (the home to deployed ratio, or in naval parlance, 'ship to shore' ratio). And there must be an appropriate balance between operations and support personnel to ensure operations are effective, supportable and sustainable.

Aerospace Force Readiness Generation



Aerospace power force readiness generation activities take place mainly at the operational and tactical levels of an air force. There must be sufficient numbers of qualified air maintenance technicians to generate MR aircraft to execute the flying program. The flying program must generate the required training sorties (upgrade and continuation) to produce and maintain the requisite numbers of qualified and certified aircrew (plus others such as aerospace controllers) required to execute force employment tasks. Training in the synthetic aerospace environment must also be exploited to complement training in the actual flying environment.

Flying Sortie and hour production

The daily *output* of a squadron is expressed as either flying hours or sorties flown. The Yearly Flying Rate (YFR) of a squadron is an aggregate of the total number of hours flown. While tracking flying hours is necessary from a resource expenditure perspective, it represents little, in and of itself, in terms of operational effectiveness. Accordingly, more meaningful metrics are required.

Flying Sortie effectiveness

The decision to count a sortie as effective – Duty Carried Out ***(DCO)*** or Duty Not Carried Out ***(DNCO)*** – rests with the aircrew involved based on their judgment of whether or not the sortie achieved its intended purpose. Air force units log the total number of DCO and DNCO sorties and calculate an effectiveness rate for each flying day. This rate is the Daily Sortie Effectiveness Rate (DSER).

Operational Effectiveness

The overall operational effectiveness of a squadron will vary according to the roles and tasks it is assigned. Responsibility for creating a Measure of Operational Effectiveness (MOE) for each unit rests with higher headquarters.

Performance Measurement

From the preceding discussion, three levels of performance measurement emerge that can be applied to squadron operations. The first two, as discussed below, should be viewed as performance measurement metrics for the purpose of continuous improvement. The third metric can be used to provide a fairly accurate picture of force generation and force employment performance.

The MR rate provides an indication of the effectiveness of the overall maintenance and supply functions. Additional insight can be gained by examining the aircraft availability rate (to assess the impact of 2nd or 3rd line activities on overall performance) and the serviceability rate (to assess the impact of squadron/wing level activities).

The DSER provides an indication of the effectiveness of the unit's overall sortie output, including the impact of maintenance, weather, equipment, range availability and other issues on overall effectiveness.

Finally, MOE provide an indication of the operational effectiveness of a squadron, from both a force generation and force employment perspective.

Three levels of performance measurement emerge that can be applied...

Force Employment

Personnel Numbers

For force generation purposes, air force units require an approximate 3:1 force generation to force employment ratio for deployed personnel. This means that for every person deployed there should be three more at home in three different stages of force generation activity: stage one, basic skill generation and certification; stage two, upgrade and continuation training; and stage three, generation of high readiness units for deployment. Leave, administration and professional development requirements must be catered for within these three stages of force generation.

Aircraft Numbers



Defence policy documents typically address air force commitments in terms of numbers of aircraft, squadrons or Wings. However, these units of measure do not provide an overall measure of the operational capabilities that must be generated to meet a specific task. Two examples illustrate this point. Operational experience has shown that it takes eight fighter aircraft to maintain a 24 hour-a-day airborne protective CAP over a single geographical location for an extended period of time. Similarly, experience has also shown that it takes at least three long-range surveillance aircraft to provide 24 hour-a-day coverage of a single geographical area. However, the total number of aircraft required to perform either of these missions can only be calculated after many other factors are known (for example, how long the 24-hour coverage must be sustained, total transit distances and so on).

The requirement for air force units to have an approximate 3:1 force generation to force employment ratio for deployed personnel was discussed above. Similar considerations also exist for aircraft. When aircraft are deployed, there must be sufficient numbers of aircraft at home for force generation activities as well as other operational tasks that may be assigned to a particular unit. As well, while aircraft are deployed for an extended period of time, some may need to be rotated in and out of theatre for routine air maintenance actions such as Depot-Level Inspection and Repair (DLIR), periodic inspections and fatigue life management.

Cost of Air Force Capability



The overall cost of air force capabilities is an important consideration. Air Forces are generally considered to be capital intensive, technology centric and readiness dependent. However, while *force generation* costs for air force units may be relatively high, *force employment* costs are generally lower than for other forces. This is because air forces can deploy and apply significant power using relatively small numbers of personnel.

When considering the cost of air force capabilities, it is important to understand overall cost behaviours. Air Force capabilities have fixed and variable costs: fixed costs being independent of activity levels; variable costs being associated with higher or lower levels of force generation or force employment activity. The cost of adding to, or subtracting from, an aerospace capability is generally non-linear. In simple terms, this means that it will not cost 20% more to add 20% more aircraft to a fleet. Conversely, there will not be a 20% savings realized by reducing a fleet by 20%. This means that additional capability can normally be added at progressively lower cost whereas savings realized from fleet reductions become progressively smaller as the total cost approaches the fixed cost of the capability.

The overall cost of air force capabilities is an important consideration.

To reduce overall costs, many air forces have undertaken alternative service delivery (ASD) initiatives or established commercial support contracts. While such arrangements can be effective, they generally come with reduced flexibility. As well, when significant changes to contracted activity levels are required to respond to changing requirements, they generally cost additional resources. Therefore, such arrangements must be carefully examined to ensure they meet operational requirements and represent best value over the longer-term.

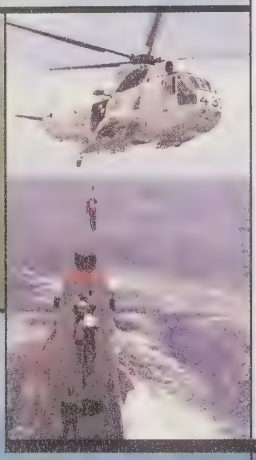
Air force maintenance and support costs are directly influenced by the maintenance and support concepts adopted by the support organizations. For example, air maintenance organizations can be either centralized or de-centralized, the former offering greater efficiency, the latter certain operational advantages. While effectiveness and efficiency must both be kept in balance, effectiveness must take precedence when organizational changes are being contemplated that could impact readiness or capability.



Chapter Two

Canada's Air Force







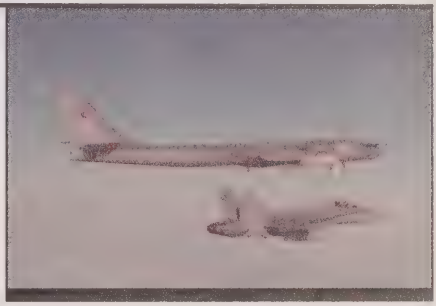
Strategic Context

Defence Policy

Canadian Defence Policy makes clear the primary obligation of the Department of National Defence and the Canadian Forces is to protect the country and its citizens from security challenges, at home and abroad. Three key objectives are established in this regard: to defend Canada; to contribute to the defence of North America in cooperation with the United States; and to contribute to international peace and security.

In terms of capability, defence policy affirms the need for Canada to maintain a prudent level of military force to deal with challenges to sovereignty in peacetime and to generate forces capable of defending the nation should the need arise. It also clearly underlines the need to maintain multi-purpose, combat-capable sea, land and air forces.

The Geo-Political Situation



The relatively stable bi-polar balance that existed globally during the Cold War has been replaced by a world that is increasingly complex, unstable and unpredictable. Among the issues that make it so are changing regional power structures; regional and intra-state conflict; the existence of failed states; proliferation of weapons of mass destruction and missile technology; environmental degradation; demographic concerns; and inequities in the distribution of global wealth. The potential for widespread and devastating terrorist attacks is a relatively recent security issue but one that is likely to play a significant role in the years ahead. While forecasting the future can be a challenge, a fair comment may be that uncertainty will be one of the few certainties of the 21st Century.

National Security

Canada's national security derives from several component parts. However, from a military perspective, two elements predominate. First, Canada must be able to demonstrate the capability and resolve to enforce peacetime sovereignty over its territory, airspace and maritime approaches. And second, it must retain the capability and will to defend the nation should the need arise. The concept of human security, while not universally accepted, presents an additional element for consideration. Canada's Air Force must (and does) contribute to national security within this broad context.

Regional Security

The United States is Canada's most important ally and the two countries maintain a relationship that is as close, complex and extensive as any in the world. Canada and the U.S. are partners in the world's largest and most comprehensive trading relationship with approximately U.S. $1.2 billion in trade crossing the Canada-U.S. border every day.



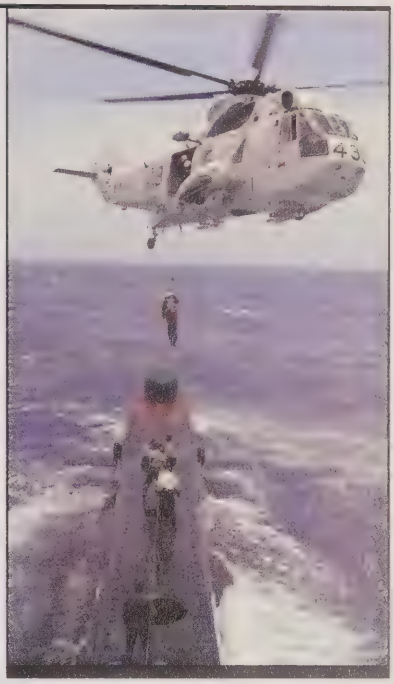
Geography, history, trust and shared beliefs have made Canada and the United States strong partners in the defence of North America. From a defence perspective, Canada – United States (CANUS) ties are longstanding and persistent, with some agreements spanning more than five decades of evolving security challenges. Today, more than 80 treaty-level agreements, 250 memoranda of understanding and 145 bilateral forums on defence exist between the two countries.

The most visible CANUS security entity is the North American Aerospace Defense Command (NORAD). For more than 45 years, NORAD has proven highly effective in carrying out its roles of aerospace warning and aerospace defence for Canada and the United States. In the aftermath of the terrorist attacks of 11 September 2001, the command demonstrated great flexibility by quickly responding to a new threat emanating from the interior of the continent, in addition to the more traditional external threats it had been used to.

Geography, history, trust and shared beliefs have made Canada and the United States strong partners in the defence of North America.

In 2002, Canada and the United States announced the formation of a Bi-National Planning Group (BPG) to deal with homeland security beyond the aerospace defence mission. The BPG, collocated with United States Northern Command and NORAD in Colorado Springs, is principally focused on maritime defence and crisis response. However, it is expected to evolve over time and, could, in the long run, even result in changes being made to the NORAD agreement.

Canadian Aerospace Power



The Army, Navy and Air Force

From a legal perspective, Canada has only one military service, the Canadian Forces (CF). The CF is comprised of three subordinate Environmental Commands – Maritime, Land Force and Air Command – collectively responsible for generating most (although not all) of the operational and support forces employed on Canadian Forces operations.

While the Canadian Forces remains a unified force, it has become common practice to refer to the three Environmental Commands as the Army, Navy and Air Force. Each of these 'services' has a distinctly different role, culture and tradition. For its part, the Air Force, in carrying out its responsibilities, must take into account its own distinct requirements, as well as those of organizations that also rely on military aircraft to accomplish their missions. Navy and Army perspectives on aerospace requirements are outlined below.

Leadmark: the Navy Strategy for 2020 defines organic air as "aerial assets integral to the task group or Tactical Self-Sufficient Unit (TSSU), whether as a continuation of the present concept of embarked helicopters or as a coincident development of Unmanned Aerial Vehicles (UAVs)". Looking to the future, it states "organic air will allow naval forces to optimize the capabilities of weapons and sensor systems by its ability to extend substantially the ISR and control capabilities of its host unit or task group." It lists defining characteristics as:

- All weather, day/night ability.
- Stand-off, remote relay, real time surveillance ability.
- Rapid response ability.
- Responsive to tactical commander's requirements.
- Limited self-defence ability.
- Limited stand-off attack capability.



The 2003 Army Strategic Operations and Resource Direction (SORD) states "the medium-weight, knowledge-based nature of the Canadian Army requires integral tactical aviation support for the provision of reconnaissance, aerial firepower and mobility." It lists the Army's key aerospace capability requirements as:

- C4 ISTAR.
- Armed reconnaissance.
- Armed anti-armour.
- Limited mobility (CASEVAC, combat airlift and command and liaison).
- Experimentation to achieve a joint land-air operational capability.
- Experimentation into the use of other air force ISR platforms.

As a distinct organization within the Canadian Forces, the Air Force's mission is directly tied to the application of aerospace power across a spectrum of activity and conflict. Thus, the generation and application of aerospace power is the primary focus of the Air Force and its personnel.

Airworthiness

In addition to operational responsibilities, the Air Force also has legal responsibilities for overseeing military aviation activities within Canada. Under the Aeronautics Act, the Minister of National Defence is assigned responsibility for implementing the DND/CF Airworthiness Program, a task delegated to the Chief of the Air Staff. Other Air Force officers are also delegated responsibilities for specific aspects of the Airworthiness Program: Technical; Operational; and Investigative. In practice, this means the Air Force must play a central role in all areas where the CF uses, or intends to use, aeronautical products (notably UAV's).

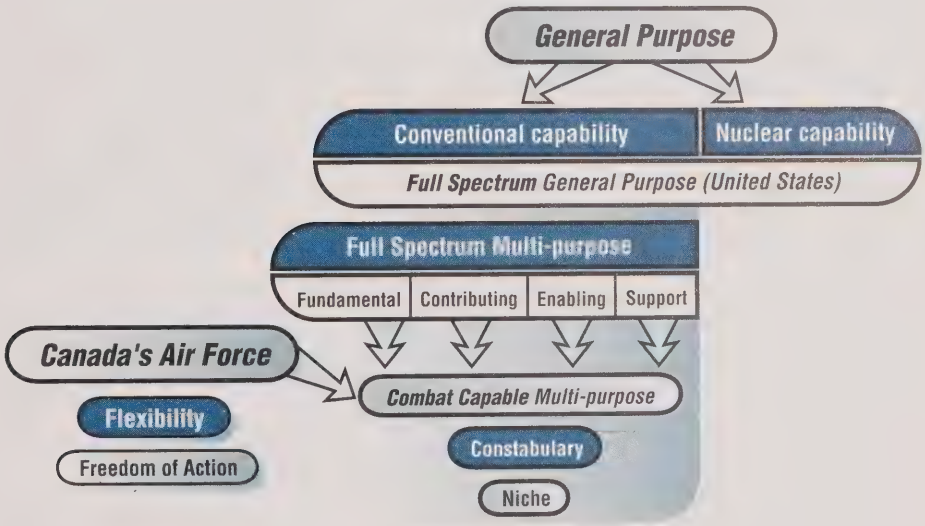
...the Air Force also has legal responsibilities for overseeing military aviation activities within Canada.

Canada's Air Force is clearly a global air force.

Canada's Air Force in the World

The broad categorization of air forces as national, regional and global was outlined in Chapter One. Given its international, regional and domestic responsibilities – as well as its overall capabilities, both present and planned – Canada's Air Force is clearly a global air force. This is an important factor in areas such as force development, training and interoperability.

The breadth of possible aerospace capabilities was also described in Chapter One. Within this construct, Canada's Air Force is not a general-purpose air force because it has no nuclear capability. It is not a full spectrum air force because it does not maintain capability across the breadth of conventional aerospace capabilities. However, it is capable of relatively responsive and rapid power projection, presence, and precision engagement and thus falls within the definition of a combat capable, multi-purpose, global air force. As such, it provides the Government with the flexibility and freedom of action required to respond to current and future security challenges, something that a niche or constabulary air force could not do.



Combined, Joint and Inter-Agency Operations

While air forces can be employed on independent operations, there are few situations where Canada's Air Force would operate alone. Moreover, as noted in Departmental strategic capability planning documents, there are also relatively few situations where all three services of the Canadian Forces would operate together as an independent joint force (except domestically). Most often, CF units will be combined with units of other nations to produce a larger formation capable of dealing with the task at hand. This means that, internationally, the Air Force will normally conduct operations as part of a combined, joint, or perhaps inter-agency force.

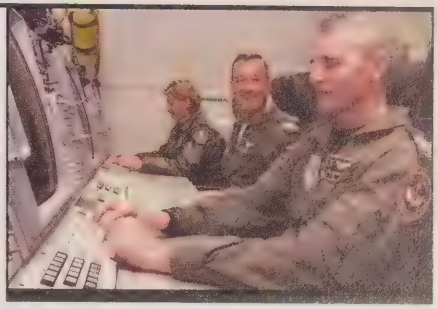
- Combined operations are those designed to coordinate the effects generated by military forces of two or more nations, working together to achieve a common military objective. Combined operations can be 'single service' but are more likely to be 'joint' in the broadest context.
- Joint operations are those designed to coordinate the effects generated by the services of a nation; in Canada's case the Army, Navy and Air Force. Joint operations should have joint missions and have command and control arrangements that reflect the contributions of the contributing services.
- Inter-agency operations are those designed to optimally coordinate the effects generated by military and non-military organizations working effectively together to achieve a common objective. Such operations may or may not be part of a military campaign.

Interoperability

Given the importance of combined and joint operations in the future, it is critical the Air Force do everything possible to ensure interoperability with other services and nations. Moreover, given the leading role the U.S. often exercises in regional and international security operations, interoperability with the U.S. must remain a dominant requirement. The key to interoperability will be the ability to communicate securely and with some degree of assurance, to share information by data-link, to avoid fratricide and, in the case of offensive platforms, to be capable of precisely delivering air-to-surface munitions. As well, since security operations will become increasingly reliant on inter-agency cooperation, equipment, doctrine and planning must take into account the requirements to work with other government departments and agencies, international aid agencies and non-governmental organizations (NGOs).

...it is critical the Air Force do everything possible to ensure interoperability with other services and nations.

Aerospace Control



Aerospace Control is a primary operational function of Canada's combat capable Air Force.

The Canadian NORAD Region (CANR) is responsible for the military surveillance of Canadian airspace. CANR executes its NORAD missions using sensors such as the North Warning System (NWS) radar system, Canadian Coastal radars, other radars and U.S. owned satellite systems used for the detection, validation, assessment and characterization of ballistic missile threats and for space surveillance. The latter systems provide information to NORAD allowing it to effectively execute aerospace warning and aerospace control missions assigned to it by Canada and the United States through the NORAD agreement. Canada also has access to U.S. owned Airborne Warning and Control System (AWACS) aircraft through the NORAD agreement.

CANR currently functions with a Region Air Operations Centre (RAOC) located in Winnipeg and a Sector Air Operations Centre (SAOC) – called the Canadian Air Defence Sector - located in North Bay. Canadian and American personnel are employed at both centres, as is the case with other centres throughout NORAD. Aerospace Controllers and Aerospace Control Operators maintain a 24 hour-a-day, seven day-a-week (24/7) watch over the approaches to Canadian airspace and are responsible for the identification of all air traffic approaching Canadian airspace.



CF-18s are also kept on 24/7 Air Sovereignty Alert (ASA) to quickly and actively respond to unauthorized and/or unwanted activity in Canada's airspace. Such activity could include drug smuggling aircraft, hijacked aircraft, unidentified aircraft approaching Canada's national airspace or, as was the case on 11 September 2001, terrorist attacks perpetrated either internally or externally. The CF-18 fleet currently represents Canada's only airborne air surveillance platform and constitutes its only means of exercising active control over unwanted activities in domestic and international airspace.



Domestically, NAV CANADA is responsible for the provision of air navigation services in Canada. It operates area (secondary) and terminal (primary) radars across Canada that principally track and monitor commercial air traffic. It is important to note that NAV CANADA is concerned with authorized air traffic and CANR is concerned with unauthorized and unwanted activity. The surveillance sensors and systems used to detect each kind of air activity do not necessarily have all of the capabilities appropriate

to effectively execute both the NAV CANADA and CANR missions. For example, secondary radars widely used for the surveillance and monitoring of commercial air traffic are of little or no use against non-cooperative air traffic or aircraft with non-functional airborne transponders.



In addition to fixed surface-based sensors, the Air Force maintains deployable air surveillance radars and air traffic control (ATC) capabilities that have been used domestically on many occasions (for example, post 9/11 and in support of the 2002 G-8 summit). Similarly, deployable ATC capabilities were used during the 1997 Winnipeg flood and 1998 ice storm in Eastern Canada. Internationally, 8 Air Communications and Control Squadron (8 ACCS) has provided various levels of deployed ATC support in many different operations such as those in Haiti in 1995, Africa in 1996, Kuwait in 1998 and Sierra Leone in 2001.

Internationally, CF-18s executed aerospace control missions during Operation Scimitar (CF-18 participation in the Gulf War) in 1991 (Combat Air Patrol (CAP) over Canadian naval forces in the Gulf and Sweep and Escort missions along side coalition strike packages); Operation Mirador in 1997 (air policing operations to monitor the airspace over Boznia-Herzegovina (BH) and to provide air security and cover for NATO troops, (including 1200 Canadians); and Operation Echo, the Kosovo Air Campaign, in 1999 (CAP, CAS and BAI missions flown during the 79 day NATO bombing campaign).

The Iraqi Integrated Air Defence System (IADS) encountered during the Gulf War was a robust, dense, overlapping, integrated and lethal system. The Serb IADS was also robust and redundant. Aircraft operating in such environments must be equipped with defensive capabilities aimed at reducing the threat posed by these systems and aircrew trained in employing tactics and systems to neutralize them.



Core control competencies include the capability to execute Air Intercept, Escort, CAP, Sweep and Conventional Surface Attack (CSA) missions. Suppression of Enemy Air Defences (SEAD) is a more specialized capability maintained by larger air forces and not considered core to Canada's Air Force. However, this does not mean SEAD is not essential; it may be absolutely essential when operating against a robust IADS. Since Canada does not maintain this capability, if required, it would need to be provided by another air force.

Aerospace Force Application has both conventional and nuclear components.

Aerospace Force Application

Aerospace Force Application is also a primary operational function of Canada's combat capable Air Force.

Aerospace Force Application has both conventional and nuclear components. While Canada does not have nuclear forces, it maintains conventional aerospace forces that could be used for Strategic Attack missions. Canada's force application capability could also be used to contribute to operations requiring coercive presence or coercive force. Since Canada does not have a bomber force, the multi-role CF-18 currently constitutes the primary combat power projection and Precision-Guided Munition (PGM) force application capability of the Air Force.

Aerospace Contributions to Surface and Sub-Surface Operations

The maritime and land forces of some countries have organic air and aviation assets; Canada's Army and Navy do not. Canada's Air Force provides aviation support to maritime and land commanders using the CH-124 Sea King (maritime) and CH-146 Griffon (land) helicopters. Although these aircraft can be used for other purposes, their key requirements derive from Navy and Army requirements.



Indirect air operations

CF-18s can be tasked to conduct interdiction missions to contribute to land operations. For example, in the Gulf war, CF-18s flew 40 bombing missions into Iraq near the end of the war and, in 1999, flew 459 air interdiction missions (many with PGMs) in the Kosovo Air Campaign.

The CP-140 Aurora, armed with Mk46 torpedos, can be used to detect, locate, track and attack submarines. This same platform can be used to search for, identify, shadow and target surface vessels.

Direct air operations

The CH-146 Griffon provides regular contributions to land operations as a Utility Tactical Transport Helicopter (UTTH). It is used for surveillance and reconnaissance, directing and controlling fires, assisting with communications and airlifting personnel, equipment and supplies.

CF-18s may be tasked with Close Air Support (CAS) missions. For example, CF-18s flew 100 CAS missions during Operation MIRADOR in 1998 over BH in the event ground troops came under fire and required support. As well, CF-18s flew CAS missions during the 1999 Kosovo Air Campaign.

The CH-124 Sea King is regularly embarked on naval ships to contribute to maritime operations. The Sea King is used for surface and sub-surface surveillance, ASW and the airlift of personnel, equipment and supplies.

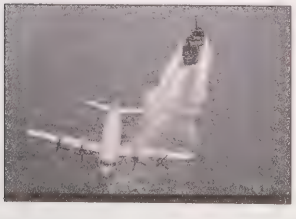
The CP-140 Aurora can be used to conduct ASW as well as surface and sub-surface surveillance. The CF-18 could also provide localized CAP over naval forces, if so tasked.

Aerospace Contributions to Operations Stemming from National Interests



Canada's Air Force protects the lives of Canadians in many ways. The most visible domestic responsibility assigned by the government is Search and Rescue (SAR) over national territory and maritime areas of responsibility. SAR is conducted using CH-149 Cormorant helicopters and a combination of CC-115 Buffaloes and CC-130 Hercules as fixed wing SAR assets. Domestic SAR responsibilities originate from article 25 of the International Civil Aviation Organization (ICAO) convention, which makes individual nations responsible for the provision of SAR services (to the extent practicable).

Air mobility aircraft such as the CC-150 Polaris and CC-130 Hercules routinely respond to disaster relief efforts and are occasionally used to evacuate Canadians from areas of conflict overseas. CF-18s are used to contribute to the deterrence of, and response to, airborne terrorist attacks and aerial drug importations. Other aircraft such as CH-146 Griffon helicopters are used to provide aid to the civil power in the event of an emergency.



The Air Force routinely contributes to fisheries protection, aerial drug importation and environmental monitoring. CP-140 Aurora aircraft routinely conduct fishery patrols in support of the Department of Fisheries and Oceans. Auroras are also used to conduct surface surveillance patrols to assist the Department of the Environment

monitor Canada's maritime approaches for pollution violations. CF-18s, CH-146s and CP-140s are used in various capacities to assist the Department of Justice counter drug smuggling in Canada. CF-18s, as part of their ASA responsibility, are used to intercept and shadow aircraft or monitor suspect vessels; Auroras are used to visually follow such aircraft; and Griffons are used to transport law enforcement interdiction teams to the site of intended landings, to make arrests.



Canada projects power and influence offshore using CF-18s, as was the case during the U.N. sanctioned 1991 Gulf War and the 1999 Kosovo Air Campaign. CF-18s, dispatched to Aviano in 1997, conducted air policing operations over Bosnia-Herzegovina (BH) and provided air cover and security for NATO forces (including Canadians). CF-18s were also dispatched to Aviano in 1998 to fly close air support missions over BH in case ground troops came under fire and needed immediate air support. CF-18s can also be used for coercive presence. For example, had the 1995 turbot fishing dispute off the East Coast of Canada escalated, capabilities represented by Canada's CF-18s and the Canadian Navy could have been considered for use in a coercive role.



While Canadians generally think of peacekeeping as an Army task, Air Force personnel have also been involved in virtually every peacekeeping operation Canada has undertaken. For example:

- Tactical helicopters regularly deploy with the Army on peacekeeping operations.
- Maritime helicopters are regularly embarked on naval ships assigned to U.N. operations.
- Polaris and Hercules aircraft are regularly used to transport food and other humanitarian and famine relief supplies to areas of critical need.
- Fighter aircraft are used for air policing, monitoring the activities of surface-based forces and providing air cover and close air support for ground forces.

Aerospace Enabling Operations

Canada does not maintain the full spectrum of aerospace enabling capabilities, many of which require highly specialized platforms (EW, AEW, Airborne Command Control and Communications [ABCCC], Airborne Warning and Control System [AWACS], Joint Surveillance Target Attack Radar System [JSTARS], Compass Call and Commando Solo aircraft. Absent these capabilities, Canada will need to rely on other nations to provide them.



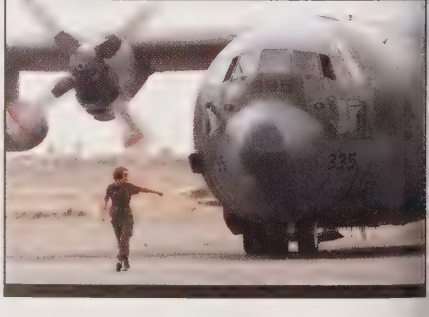
The Air Force has focused on maintaining the most critical enabling capabilities such as airlift and AAR aircraft (intra and inter-theatre). These aircraft are required to ensure the nation is not completely dependent on other nations or entities for critical deployment, employment and redeployment capabilities and to sustain forces once deployed. This requirement is not based solely on deployments internationally, but also within Canada, given its vast geography.



VIP Air Transport is a task assigned to DND by the government. The Air Force operates a small fleet of six CC-144 Challenger aircraft, four of which are used to provide VIP airlift support to the Government.

Combat Search and Rescue (CSAR) is considered a national responsibility, one essential to retrieve military personnel such as downed aircrew during combat operations. The Air Force has no plans to acquire CSAR aircraft, so we must rely on allies to provide this important capability. CSAR will be discussed later in this document.

A Canadian ISR aircraft is considered an essential capability for contemporary combat operations. The transformation of the CP-140 Aurora into an ISR aircraft - with air, surface and sub-surface surveillance capabilities - is discussed later in this document.



Aerospace Support

As an air force with global responsibilities, Canada's Air Force requires a variety of support capabilities to effectively employ, support and sustain operations at home and abroad. Each of the support capabilities discussed in Chapter One, if not organic, needs to be provided or acquired.

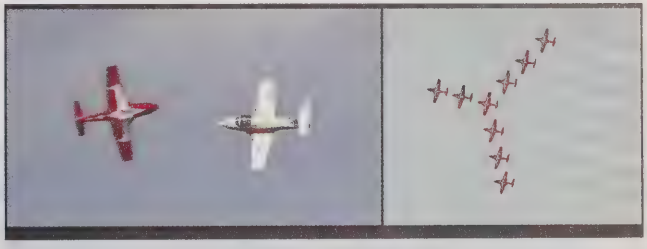
Other Aerospace Operations



Utility operations in the north are conducted with four CC-138 Twin Otter aircraft based at Yellowknife. These aircraft are used to support the Canadian Rangers and Cadets in northern Canada and provide airlift support, VIP and utility transport for other DND and government agencies. Utility operations are also conducted with 10 CH-146 Griffon helicopters distributed among Cold Lake, Bagotville and Goose Bay to provide a rapid response to local emergencies during flying operations. Furthermore, Griffons at Cold Lake are used for air weapons range maintenance while, at Goose Bay, they support Allied flying training. All utility aircraft can be tasked with SAR and medical evacuation services if required.

The Snowbirds represent Canada and the Canadian Forces at air shows across North America...

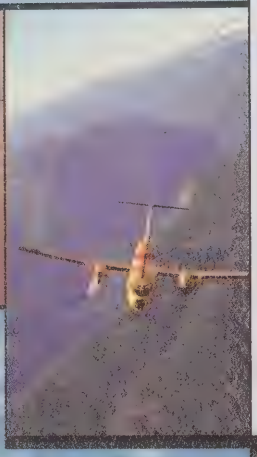
Canada's air demonstration team became an established formation within the Air Force in 1978 when 431 (Air Demonstration) Squadron was formed. The Snowbirds represent Canada and the Canadian Forces at air shows across North America, serving as an important public relations and recruiting tool.



Chapter Three

Past, Present *and* Transformatio







The Recent Past

In 1989, the Warsaw Pact announced deep cuts to its conventional forces. The Berlin Wall fell in November 1989 and Germany became a unified nation in October 1990. The break-up of the Soviet Union in December 1991 officially marked the end of the Cold War era.

Expectations of a "peace dividend" were raised in the West even before the end of the Cold War and most Western nations began to reduce military forces in the early 1990s. In Canada, federal budgetary and defence policy documents signalled the need for defence reductions as early as 1989 (further outlined in Annex F). In 1994, the Defence White Paper made clear the Government's intention to cut staff, infrastructure, equipment, training and operations to address fiscal imbalances.

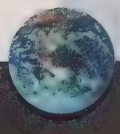
From an Air Force perspective, the 1994 White Paper – in addition to general reductions levied on the CF as a whole – also directed that expenditures on fighter forces and support be reduced by at least 25%. To achieve these savings, the Air Force was required to retire the 45 aircraft CF-5 fleet, cut the cost of fighter-related overhead, reduce annual authorized flying rates and cut the number of operational aircraft from 72 to between 48 and 60. The Air Force carried out these actions as directed, achieving a 25% reduction in two years and a 31% reduction by FY 98/99.

The White Paper also directed the Department to reduce personnel and resources assigned to headquarters by at least one-third. From an Air Force perspective, 1 Canadian Air Division in Lahr, Germany had already been disbanded in 1993, coincident with the withdrawal of CF-18s from Europe. In 1997, Air Command disbanded five existing Air Group headquarters and created a single new operational-level headquarters at Winnipeg (1 Canadian Air Division/ Canadian NORAD Region).

The restricted availability of funds throughout the 1990s led to a number of other Air Force reductions during the period. Capabilities or fleets eliminated included:

- 63 CH-136 Kiowas, 44 CH-135 Twin Hueys, nine CH-118 Iroquois and seven CH-147 Chinook helicopters (replaced by 100 CH-146 Griffons) between 1991 and 1998.
- 19 CP-121 Tracker Medium Range Patrol Aircraft in 1990.
- Seven CC-109 Cosmopolitan transport aircraft in 1994.





- Fighter reconnaissance (with retirement of the CF-5) in 1995.
- Two CC-142 Dash 8 passenger aircraft in 2000. And,
- Six CC-144E Challengers and 38 CT-133 Electronic Warfare Training and Support aircraft in 2002 (to be replaced by a contracted capability).

Past Adaptation



Between 1989 and 2003, Air Force reductions were undertaken concomitant with evolutionary adaptation in response to the strategic environment of the later 20th Century. Initiatives included:

- Partnering with Canadian industry for air maintenance support of Air Force fleets. Contractual arrangements include the following industry support:
  - Third line – CF-18 Hornet, CP-140 Aurora, CC-130 Hercules, CH-124 Sea King, CH-146 Griffon and CC-115 Buffalo; and
  - First, second and third line – CC-150 Polaris, CC-144 Challenger and CH-149 Cormorant.
- Establishing contractor-supported primary flying training, basic helicopter and multi-engine flying training at Southport (formerly Portage La Prairie) Manitoba, through the Contracted Flying Training and Support (CFTS) contract. Operations commenced in 1992.
- Combining 13 air maintenance technical trades into three occupational categories in 1996.
- Acquiring a Precision-Guided Munition (PGM) capability for the CF-18 fleet in 1997.
- Combining the Air Traffic Controller (ATC) and Air Weapons Controller (AWC) occupational officer categories into a single Aerospace Controller (AEC) occupational category, commencing in 1997.
- Combining the Air Traffic Controller (Air T con) and Air Defence Technician (AD Tech) occupational NCM categories into a single Aerospace Control Operator (AC Op) occupational category, commencing in 1997.
- Establishing contractor-supported basic pilot training, advanced jet training and fighter lead-in training through the NATO Flying Training in Canada (NFTC) contract. Operations in Moose Jaw and Cold Lake commenced in 2000.

The Current Baseline

As the Air Force enters the 21st Century, it is significantly smaller than it was at the end of the Cold War. Today, the Air Force has 48% fewer Regular Force military personnel, 69% fewer civilians, 56% fewer aircraft and 59% fewer flying hours than its 1989 predecessor. This information is further outlined in Annex A.

The cumulative effects of budgetary, personnel and other pressures over the past decade have had a significant impact on Air Force capabilities, particularly in terms of sustainability. The most significant issues facing the Air Force are as follows:

- Personnel shortfalls. A shortage of personnel, particularly experienced personnel, is having a significant impact on certain parts of the Air Force. While recruiting is not an issue, the Air Force's ability to absorb and train new recruits (particularly in air maintenance occupations) is increasing the overall workload at units and having a negative impact on operational capacity.
- Resource Limitations. Reduced funding, particularly in the Air Force portion of the National Procurement budget, has resulted in shortages of spare parts, delays in second and third line maintenance inspections and reduced availability of aircraft for operations and training. This has also had a negative impact on morale at the unit level. And,
- Operational tempo. The campaign against terrorism and other ongoing operations have had a significant impact on operational tempo, hence personnel tempo. This has been exacerbated by the personnel and experience shortfalls described above.

From an equipment perspective, the following chart illustrates the current baseline for Key operational fleets.

Air Force Fleets	Total	Operational	MR[1]
CF 18	80	48	34
Griffon	75	54	42[2]
Hercules	32	23	13[3]
New Maritime Helicopter	28	15	11[4]
Aurora	16	11	6-7

Notes:
[1] Representational Mission Ready (MR) numbers. Will vary with aircraft serviceability, spares, personnel manning and capacity of air maintenance organizations.
[2] Refers to number directly supporting the Army
[3] Refers to Lines of Tasking.
[4] Refers to number of HELAIRDETS.

Despite the problems and reductions noted above, it is important to acknowledge that considerable capability still exists within the Air Force. Operationally, the Air Force has been highly effective over the past decade and continues to be so today. While much credit for operational success goes to the dedicated men and women in Air Force units and headquarters, overall efforts to preserve and upgrade core combat capabilities have also had a positive impact (one that will increase as modernization programs begin to deliver). While significant challenges exist, the Air Force is generally well positioned to undertake the comprehensive transformation required to meet future requirements.

Air Force Transformation – The Strategy



Departmental Context

The Department defines transformation as "a departmental process of strategic re-orientation in response to anticipated or tangible change to the security environment, designed to shape a nation's armed forces to ensure their continued effectiveness and relevance." It further notes that transformation seeks to "blend existing and emerging systems and structures to create greatly enhanced capabilities relevant to future missions, roles and tasks."

Air Force Strategy

The Air Force has developed a coherent strategy to address current concerns and challenges and guide Air Force transformation and development over the near, mid and longer-terms. The stabilization component of the strategy focuses mainly on near and mid term issues, while the transformation component addresses the near, mid and longer terms.

Air Force Stabilization Strategy

There are three main elements of the Air Force Stabilization Strategy. These are:

- The Air Force Personnel Retention Plan;
- The Air Force Personnel Tempo Strategy; and
- Project Transform (Phase I)

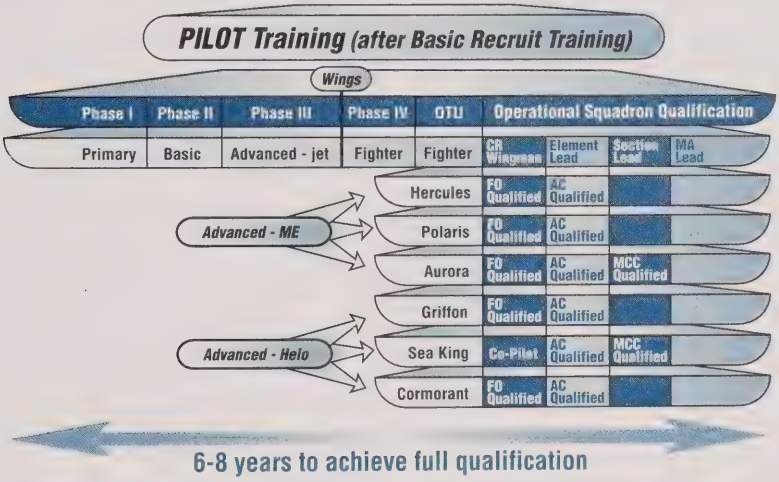
Personnel Retention



Demographic research clearly indicates that, left unchecked, attrition rates within the Air Force could double over the next five years and not stabilize at lower levels until at least 2012. In the case of air technicians, for example, as a result of the Force Reduction Plan (FRP) and reduced recruiting, attrition (particularly at the critical experience level of 19 to 23 years service) is forecast to nearly triple by 2007. When economic forecasts and industry demographics are considered, it is clear that retention of trained personnel will be a significant challenge. The Air Force Personnel Retention Plan is therefore one of the key elements in the overall Air Force Stabilization Strategy.

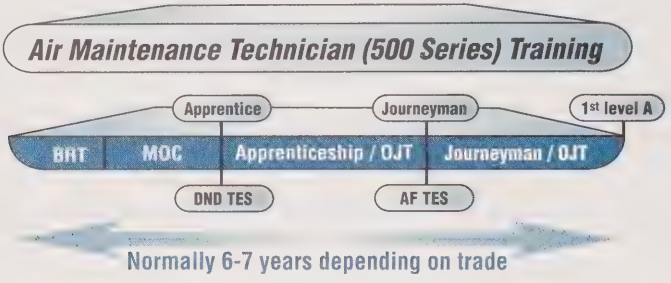
The direct link between attrition and the economic cycle is well documented. While the current economic slowdown has provided some respite, the situation is expected to change when airlines and other commercial organizations begin to once again hire. Air Force personnel are attractive to industry and frequently targeted by recruitment campaigns because of training, experience and skill-transferability. Recovery from an excessive loss of qualified and experienced personnel can take many years and involve significant costs.

By way of example, basic and advanced pilot training is expensive and spaces are limited. Beyond this, the training required to bring individual pilots to full operational capability is substantial. In addition to operational training for a particular role and aircraft type, pilots (and other aircrew) require experience on operational units to become fully effective in their assigned missions. This training can extend as much as four years beyond the OTU point.



Similarly, the training of air maintenance technicians does not stop at the TQ3 level, the point at which the Department currently considers them part of Trained Effective Strength (TES). Rather, training continues for several years thereafter. If units are to function effectively, the TES designation point needs to be changed to accurately reflect the stage of development at which an individual becomes truly effective. If this designation is made too early (as is the current situation) experience shortfalls will be understated and unit productivity suffer.







The Air Force Personnel Retention Plan, put in place to deal with all Air Force MOCs, initially focused its efforts on the pilot classification. This was done for three reasons: first, the Pilot MOC has faced significant attrition for some time; second, the Pilot Terminable Allowance ended in 2003 making a significant number of pilots eligible for unrestricted release; and third, pilots are among the most marketable of all Air Force personnel and arguably the most expensive and difficult to produce. Nevertheless, the Air Force Retention Project is also monitoring the health of all other Air Force MOCs, maintaining a watch-list of attrition factors, developing intervention/mitigation strategies, making recommendations to address specific issues and intervening – one person at a time – to improve overall retention across the Air Force.

The Air Force Personnel Tempo Strategy complements the Air Force Personnel Retention Plan.

Personnel Tempo Strategy

The Air Force Personnel Tempo Strategy complements the Air Force Personnel Retention Plan. Personnel tempo must be high enough to provide people the opportunity to practice what they have trained to do and to derive personal and professional satisfaction from their careers. On the other hand, if personnel tempo becomes too high, it can produce dissatisfaction and ultimately contribute to individuals leaving the service. The Air Force must ensure an appropriate balance between operational employment (deployed and static), professional development and personal/family time.

Since personnel tempo is affected by operational tempo, the senior leadership of the CF routinely recommends not deploying specific capabilities or units on operations based on the negative impact this would have on individuals. The Air Force has also adopted more flexible deployment patterns as a means of reducing the impact of deployments on individuals (12 V, '56 day rotation' etc). Notwithstanding these efforts, personnel tempo is expected to be a significant issue during the forthcoming transformation period. It has therefore been highlighted as a critical element to be addressed through Project Transform and other staff action at the Air Staff/1 CAD level.

Project Transform (Phase I)

Project Transform, initiated in 2002, forms a bridge between the stabilization and transformation components of the ACF implementation strategy. Project Transform (Phase I) is a stabilization element that will examine and identify the current operational health of the Air Force by means of a Force Generation Capacity Assessment. It will indicate what the Air Force is (and is not) capable of doing given current budgetary allocations and personnel resources.





Air Force Transformation Strategy

There are two main elements of the Air Force Transformation Strategy. They are :

- Project Transform (Phases II and III); and
- Project Re-Balance

Project Transform (Phases II and III)

The two transformation elements of Project Transform include:

- Phase II – The Transformation Element will establish the force structure and readiness levels required to ensure longer-term operational viability and relevance of all Air Force capabilities.
- Phase III – The Budgetary Element will address issues such as resource requirements, potential offsets and shortfalls associated with transformation.

Project Re-Balance

The overall Air Force establishment must be balanced in three ways. Personnel establishments must be large enough to allow units to accomplish their assigned tasks. There must be a sufficient number of personnel available to ensure a balance between force generation and force employment (home airfield to deployed force ratio), and there must be a balance between operations and support personnel for operations to be effective, supportable and sustainable.

Project Re-Balance will examine the overall Air Force establishment.

Cumulative reductions in the Air Force establishment since 1989 have occurred without benefit of a comprehensive assessment of potential longer-term impacts. To this end, Project Re-Balance – to be initiated subsequent to completion of Phase II of Project Transform – will examine the overall Air Force establishment, including headquarters and related organizations, from a force development perspective.

Operational Research Support

The reviews discussed above will ultimately result in new force structure proposals for the Air Force. Project Transform will then be used to develop a coherent plan to generate the forces necessary to implement the agreed way ahead. Given the complexity of the various initiatives, force development will be aided by operational research analysis using the following operational research models:

- Air Force Structure Analysis (ASTRA) model to assess aircraft and aircrew force structure options in phase II of Project Transform; and
- Enhanced Risk Assessment Model (EnRAM) and Regular Force Establishment Validation and Modeling Project (REVAMP) to assess personnel force structure options in phase II of Project Transform and Project Re-Balance.

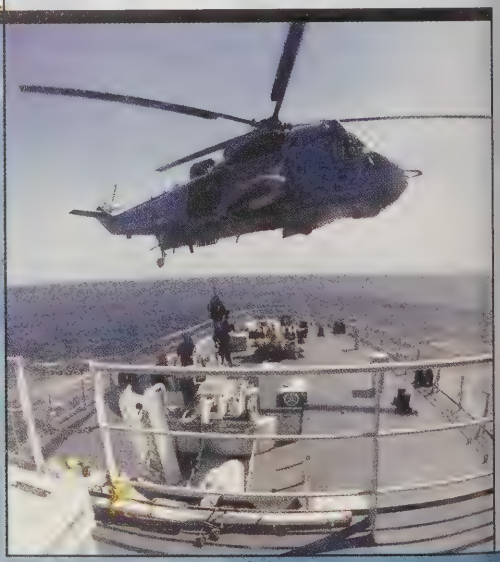


Chapter Four

Transformatio Vision







Air Force Transformation – The Vision



Institutional Responsibilities

Canada's Air Force is a vital national security institution that exists within the profession of arms. The Air Force generates the vast majority of aerospace power in the country and is the national institution responsible for stewardship and development of military airpower.

The Air Force must be capable of executing all key operational functions. This means being able to conduct aerospace control and force application and also contribute to land and maritime operations. It also means being able to support and sustain these operations to meet overall Canadian Forces commitments.

Command and Leadership Responsibilities

The successful execution of Air Force operations depends on effective command and leadership. Command is the authority and responsibility vested in an individual to direct, coordinate and control military forces. The authority of command must be exercised by effective and ethical leaders within a leader-follower construct built on trust and care for the well being of subordinates. Trust instills confidence and provides the foundation on which to build a cohesive team capable of effectively executing military operations.

To be successful, Air Force commanders and leaders must make timely decisions and provide direction pertinent to the planning and execution of aerospace operations. This requires a well-developed ability to think four dimensionally – three spatial and one temporal – sometimes referred to as 'situational awareness' (SA). Situational awareness is not innate, but comes with experience gained by dealing with the unique spatial-time relationships associated with aerospace platforms.



Individual Responsibilities

To effectively discharge their responsibilities, Air Force personnel must understand aerospace power in all its forms: what an air force does and why; the role of Canada's Air Force; how and why the Air Force has evolved as it has; and how aerospace power can be used to best effect. While a general understanding of aerospace power can be derived academically or through association with aerospace operations, there is no substitute for first-hand operational experience.

The Air Force Vision

An Air Force based on excellence and professionalism, equipped, trained and ready to prevail in combat, with the reach and power to effectively contribute to national and international security.

The Air Force vision, as summarized in Strategic Vectors, aims to strategically re-orient the Air Force to respond to the 21st Century security environment. The vision is underpinned by four main themes, each of which will be discussed further:

- Institutional excellence
- Institutional and personal professionalism
- Combat capability (as the basis for other capability)
- Reach and power appropriate to global interests

Institutional Excellence

Heritage

Since the formation of the RCAF on 1 April 1924, operational excellence has been one of the hallmarks of Canada's Air Force. During the Second World War, the RCAF grew to become the fourth largest allied air force and emerged from the war as a highly regarded and respected professional fighting force. During the Cold War, the Air Force played a key role defending North America as part of NORAD and Europe as part of NATO. During this period, while the Air Force did not engage in actual combat, Air Force units regularly distinguished themselves during operational evaluations and major Allied exercises and competitions. They also contributed to a variety of peacekeeping, peace support and humanitarian operations.

...operational excellence has been one of the hallmarks of Canada's Air Force.

Excellence in Operations

Since 1989, the Canadian Government has committed the Air Force to a wide variety of challenging operations, in Canada and in many parts of the world. These operations have involved all capabilities and Air Force personnel have consistently performed their duties in an outstanding manner. Examples of operations are highlighted below:



• **Fighters.** In the 1991 Gulf War, CF-18s generated twice the number of combat sorties as other allies in proportion to their numbers (Op FRICTION). In 1996, CF-18 crews won top honours competing against the USAF at William Tell, a prestigious air-to-air weapons competition. In 1999, CF-18 pilots effectively led one-half of the coalition sorties in which they flew during the Kosovo Air Campaign (Op ECHO). In June 2002, to protect leaders against potential terrorist attacks, CF-18s provided top cover for the G-8 Conference in Alberta, (Op GRIZZLY).



• **Long-Range Patrol.** Between 1993 and 1995, CP-140 Aurora crews contributed to UN sanctioned Maritime Interdiction Operations (MIO) over the Adriatic (SHARP GUARD). In 1996, CP-140 crews took top honours at the Fincastle ASW competition. Auroras provided critical surface surveillance capability during the 1997 Manitoba flood relief and the 1998 ice storm in Eastern Canada. From 2001-2003, CP-140s were involved in MIO and other missions in the campaign against terrorism (Op APOLLO).



• **Maritime Aviation.** In 1991, CH-124 Sea Kings embarked on Canadian ships provided surface surveillance and assisted Naval Boarding Parties during the Gulf War (Op FRICTION). In 1993-94, Sea Kings also played a significant role in support of the UN sanctioned embargo of Haiti (Op FORWARD ACTION). From 1993 to 1996, they participated in the UN sanctioned embargo of the Former Republic of Yugoslavia (Op SHARP GUARD). In 1992/93, Sea Kings provided logistics and reconnaissance support to Canadian Forces in Somalia (Op DELIVERANCE). During a daring rescue in March 2000, Sea Kings plucked 13 survivors from life-rafts and open water after the Panamanian-registered ship 'Leader L' went down 700 kilometres northeast of Bermuda.



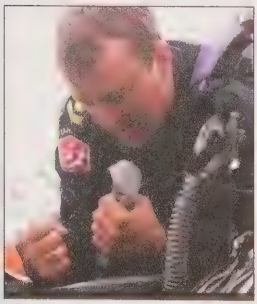
• **Land Aviation.** CH-146 Griffon helicopters have been involved in an extraordinary number of operations over the past decade. These include responding to floods in Quebec (1996) and Manitoba (1997) as well as the ice storm in Eastern Canada (1998). In 1998, CH-146s deployed to Honduras in response to Hurricane Mitch, flying 223 missions and transporting 782 passengers and 361,062 pounds of humanitarian aid (Op CENTRAL). Since November 1998, CH-146s have been deployed to Bosnia-Herzegovina, providing critical reconnaissance and airlift support to Canadian and allied army forces (Op PALLADIUM).



• **Air Mobility.** CC-130, CC-137 and CC-150 transport aircraft have been involved in an immense number of operations since 1989, providing critical support to Canadian Forces and responding to humanitarian crises in Canada and abroad. In 1991, CC-137 AAR aircraft supported coalition missions involved in the Gulf War and CC-137s and CC-130s helped deploy and re-deploy personnel, materiel and equipment to the region (Op FRICTION). In 1998, CC-130 tankers in Kuwait provided AAR support to coalition aircraft (Op DETERMINATION). In 1998, CC-130s flew scores of missions to deploy and support Canada's response to Hurricane Mitch in Honduras (Op CENTRAL). Since October 2001, CC-150 and CC-130 aircraft have performed superbly as part of the campaign against terrorism (Op APOLLO).



• **Search and Rescue.** Air Force SAR forces typically respond to between 7,000 and 8,000 requests for assistance annually. In November 1996, two SAR Techs parachuted from a CC-130 into the sea off Northern Quebec to attend to a sick crewman on the fishing vessel Vesturvon, receiving the Medal of Bravery for their efforts. In 1998, a 442 Squadron CH-113 dramatically rescued four crewmembers off a sinking fishing vessel near Vancouver Island, earning the Squadron the Mynarski Trophy for that year. In December 2002, a CH-149 rescued an injured crewman from a Norwegian bulk carrier, refuelling from an offshore oil rig and setting a Canadian distance record in the process.



• **Air Demonstration.** Canada's aerobatic team, the Snowbirds, performs annually in air shows throughout North America, promoting Canada and the Canadian Forces. The pilots and technicians who make up the Snowbirds come from all operational communities and all parts of the nation. The precision performances of the Snowbirds are supplemented by CF-18 aerobatic displays plus static and flying displays of other Air Force aircraft and equipment.



U.S. Airforce Photo

• **AWACS.** While Canada does not operate AWACS aircraft, it contributes significant resources to the NATO Airborne Early Warning Force (NAEWF) and the USAF AWACS force. Canadian AWACS personnel have been centrally involved in operations such as the 1991 Gulf War (Op DESERT STORM); the enforcement of 'no-fly' zones over Iraq from 1992 to 2003 (Ops NORTHERN and SOUTHERN WATCH); the 1999 Kosovo Air Campaign (Op ALLIED FORCE); and the campaign against terrorism in the United States in 2001-02 (Op EAGLE ASSIST).



• **Aerospace Support.** While support forces provide essential services to enable and sustain each of the operations discussed above, they also perform missions on their own. In 1998, Air Force personnel were deployed to Italy to help rescue and recover personnel injured or killed in severe mudslides (Op SARNO). In May 2000, Mobile Air Movements Section (MAMS) personnel deployed to Sierra Leone, where they facilitated the arrival of troops and handled more than 2.4 million kg of freight and baggage during a three-week period (Op REPTILE). In August 2000, Airfield Engineers deployed to Tirana, Albania, to help rebuild the civilian portion of the airfield tarmac (Op ARTISAN).

Enhancing Excellence

While the Air Force has consistently demonstrated operational excellence in the past, it must do everything possible to ensure it remains relevant, effective and efficient – and, in terms of allies and coalition partners, a partner of choice. Specific measures being undertaken in this regard include:

- Putting quality first. This means that in those areas where the Air Force maintains a capability, it will aim to be 'world class'.
- Establishing, achieving and maintaining high standards of performance.
- Leveraging on a well-educated, informed and ethical team of Regular, Reserve and civilian members.
- Continuing to exploit new technology and doctrine to capitalize on the capabilities inherent in aerospace power.
- Applying initiative and innovation to deal with change.



Institutional and Personal Professionalism

The term profession is defined in Duty With Honour: The Profession of Arms In Canada as follows:

> ***"A profession is an exclusive group of people who possess and apply a systematically acquired body of knowledge derived from extensive research, education, training and experience. Members of a profession have a special responsibility to fulfill their function competently and objectively for the benefit of society. Professionals are governed by a code of ethics that establishes standards of conduct, while defining and regulating their work. This code of ethics is enforced by the members themselves and contains values that are widely accepted as legitimate by society at large."***

Quality people are the foundation upon which aerospace power is generated, applied and sustained. The Air Force team comprises Regular, Reserve and civilian members as well as spouses, families and other support agencies. As the CDS stated in his 2001-02 report to government:

> ***"Our people are our lifeblood, and the military demands more from its people than perhaps any other profession – namely, it asks them to serve anywhere, anytime and with unlimited liability. In other words we ask our men and women to be prepared to sacrifice their lives as part of their job. In return, we have an obligation to keep their needs and those of their families at the forefront of our thinking and decision-making."***

There are five key attributes associated with Canada's professional Air Force:



- Personal professionalism means being part of the profession of arms. A professional air force develops individuals who are ethical leaders; who possess an outstanding knowledge of aerospace doctrine and operations; who understand and nurture the Air Force culture; who take advantage of professional development education and training; who develop skills within their individual military occupational classifications through exposure to appropriate line and staff assignments; and who bring a life-long commitment to learning and self-improvement.
- Operational professionalism means having personnel with the appropriate training, attitude, physical capacity and mental skills needed to perform assigned tasks.
- Teamwork means having an appropriate commander, leader, subordinate construct. Good teamwork requires trust, which in turn improves confidence and cohesiveness. Teamwork requires good decision-making and direction – telling people what to do, not how to do it and encouraging initiative, ingenuity and common sense. And it requires institutional and individual concern for the health and well-being of subordinates, including an appropriate work-family balance.
- Workplace professionalism means dealing with personnel on the job with courtesy and respect.
- Individual satisfaction relates directly to job performance and self-fulfillment: making a meaningful contribution; having pride of purpose; and having commitment, dedication, esprit de corps and motivation.

Combat Capability

The Air Force must be capable of executing operations across the entire spectrum of conflict, from peace to war. As expressed elsewhere in this document, this means having the personnel, platforms, equipment, weapons, materiel, infrastructure and training required to conduct combat operations.

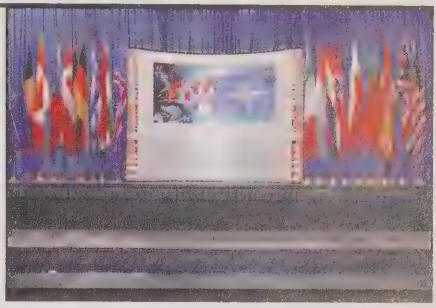


An air force that is equipped, trained and ready to prevail in combat requires forces able to work alongside allies to carry out challenging missions against high-quality adversaries. This level of capability means the Air Force requires:

- Aircraft and other systems appropriate for their anticipated operational roles. Proper equipment is vital. While aircraft acquired for combat can generally perform peacetime roles, the reverse is not true.
- Aircraft equipped to operate during the day, at night and in a variety of weather conditions. Such aircraft must also be equipped with systems designed to warn of, and help protect against, Integrated Air Defence Systems (IADS) composed of Anti-Aircraft Artillery (AAA) and Surface-to-Air Missile (SAM) systems.
- Properly trained forces able to conduct operations throughout the spectrum of conflict. Since aircrews are most likely to directly engage the enemy and since combat skills are perishable, aircrew must be provided adequate opportunity to regularly practice their skills.
- Units held at appropriate levels of readiness. Readiness relates to how quickly a force can respond and is a direct product of training and equipment availability. Responsiveness is one of the key advantages of aerospace power. To be responsive, Air Force units must be kept at relatively high states of readiness.
- Sufficient depth to sustain operations once engaged. Depth depends on numbers of people and aircraft, plus stockpiles of ammunition and other consumables. While depth does not of itself determine quality, it directly affects the ability of the Air Force to sustain operations over time.
- An appropriate balance between operations and support. While the raison d'être of the Air Force is operations, robust support capabilities are essential if units are to be capable of deploying, conducting sustained operations and re-deploying effectively.
- Appropriate infrastructure to support operations and accommodate personnel. Given the requirement to operate from austere bases, at least some capability must be available to provide infrastructure enhancements at bases in Canada and abroad.
- Interoperability with other services and nations. Interoperability means having the ability to communicate securely, and, for combat operations, to share information by datalink. Combat identification systems are required to avoid fratricide. For offensive missions, precision-guided munitions (PGMs) are needed to accurately and effectively attack targets while minimizing collateral damage. Interoperability with the U.S. is an important consideration given the leading role the U.S. exercises in regional and international security operations. And,

- Sufficient numbers of Air Force personnel and platforms to ensure critical mass. Critical mass means having an ability to maintain readiness at assigned levels or conduct operations while still carrying out appropriate force generation functions.

Reach and Power



As the CDS stated in his 2002 report At a Crossroads:

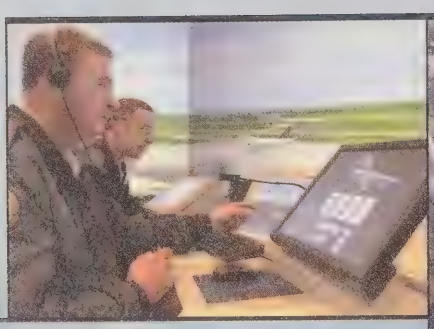
> ***"We have gone from an organization structured and ready to come to the aid of the North Atlantic Treaty Organization (NATO), mainly with forward-deployed forces in Europe, to an organization that must be ready to answer the Government's call to action on a global basis in a wide variety of missions and tasks, from humanitarian assistance to combat operations. We must look at readiness levels, examine ways to guarantee our ability to deploy globally and seek to remain interoperable in key areas with our allies, particularly the United States."***

Reach and power appropriate to global interests means the Air Force must have abilities to:

- Fly combat aircraft (using air-to-air refuelling if necessary) to, from and within an intended area of operations.
- Precisely locate, identify and designate targets from the air during the day, at night and in a variety of weather conditions.
- Apply force from the air with precision against airborne, surface-based and sub-surface targets during the day, at night and in a variety of weather conditions.
- Confirm the effects of applied force and the need to re-apply force to achieve desired effects.
- Transport equipment, supplies and personnel to, from and within an intended area of operations.
- Conduct and sustain operations (including combat operations) in those regions where the government determines it has (or may have) security interests. And
- Work effectively within a combined, inter-agency or joint environment in terms of C4ISR (command, control, communications, computers, information, surveillance and reconnaissance), combat identification, doctrine, training and equipment.

Chapter Five

Planned Transformatio







U.S. Airforce Photo

In discussing transformation, this chapter utilizes photographs of some aircraft and capabilities not currently part of the CF inventory. These images are representational and not intended to presuppose solutions to requirements yet to be defined or decisions yet to be taken by the Department and Government.

Air Force Transformation

The Air Force transformation plan is consistent with the Department's overall vision of transformation, which foresees the blending of existing and emerging systems and structures to create enhanced capabilities relevant to the future. Air Force transformation will take place within the context of the following vision statement:

> ***An Air Force based on excellence and professionalism, equipped, trained and ready to prevail in combat, with the reach and power to effectively contribute to national and international security.***

Air Force transformation will require the introduction of new capabilities and resources and, potentially, the elimination or re-focusing of others. Transformation will be an evolutionary process and will extend over the time period of the ACF.

This section of the ACF highlights some of the more significant projects, initiatives and studies that will be undertaken in support of Air Force transformation. While transformation is a long-term process, most of the projects outlined in this version of the ACF will be undertaken within Horizons One and Two.

Projects and initiatives will be presented within the context of the four pillars of the Air Force vision, namely

- Institutional excellence
- Institutional and personal professionalism
- Combat capability (as the basis for other capability), and
- Reach and power appropriate to global interests



Institutional Excellence

Stewardship and Development of Aerospace Power

The Air Force has institutional responsibility for the stewardship and development of military aerospace power in Canada. To help ensure Canadian aerospace power remains relevant into the future, the Air Force:

- Has designated an Aerospace Doctrine Authority (ADA) and formed an Aerospace Doctrine Committee (ADC) to facilitate the regular production of aerospace doctrine consistent with CF doctrine and relevant to contemporary operations;
- Will soon promulgate new Basic and Strategic Aerospace Doctrine manuals. Canadian doctrine will be consistent with that of the United States, wherever possible, while recognizing uniquely Canadian circumstances and requirements;
- Will establish Capability Advisory Groups (CAG) to replace the current Community Advisory Groups. These Groups will be assigned responsibility for the stewardship of specific aerospace capability expertise and doctrine; and
- Will undertake organizational and other changes as required to transform the Air Force in the years ahead.

Canadian Forces Aerospace Warfare Centre

The Canadian Forces Aerospace Warfare Centre will be the 'engine' of Air Force transformation.

The Canadian Forces Aerospace Warfare Centre (CFAWC) will be the 'engine' of Air Force transformation. CFAWC will become the centre of excellence for operational and tactical level aerospace doctrine development, professional development and education and Concept Development and Experimentation (CD&E). In addition, CFAWC will coordinate efforts to provide an advanced synthetic environment and modelling and simulation services to assist requirements definition, operational test and evaluation (OT&E) and mission rehearsal. The fundamental hypothesis of CFAWC is to understand the interrelationship that exists between operational analysis, lessons learned, concept development, historical analysis, education and doctrine and to use these to improve actual operational capabilities in a timely manner.

Institutional and Personal Professionalism

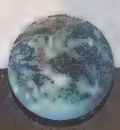
Development and Care of Air Force Personnel

People are and will continue to be the professional foundation of the Air Force. Air Force transformation will rely heavily on highly educated, informed and ethical personnel at all rank levels to exploit capabilities that will come with new equipment, doctrine and operational concepts.

Air Force Personnel Plan

The overall Air Force Personnel Plan complements broader Canadian Forces initiatives. This plan includes efforts to:

- Develop an Air Force Personnel Retention program to measure the health of Air Force military occupations on an ongoing basis and make specific recommendations on retention and recruiting initiatives;
- Develop an Air Force Leadership Model to complement initiatives undertaken by the CF Leadership Institute;
- Develop an Air Force Professional Development Model consistent with Officership 2020 and the NCM Corps 2020 and complementing initiatives to be undertaken by the Canadian Defence Academy;
- Review Air Force training (summarized at Annex B) to ensure the continued relevance, standardization and effectiveness of all Military Occupations (MOC);
- Review, in conjunction with DCDS and VCDS staff, all Air Force positions assigned to NATO and NORAD (outlined at Annex G) to ensure continued relevance and appropriate balance;
- Review Air Force exchange positions (outlined at Annex G) to ensure continued relevance and appropriate balance;
- Develop a 'cross-community' operational squadron exchange program aimed at improving communication and understanding among the various operational communities of the Air Force;
- Standardize instructional material used to teach Air Force customs, traditions and doctrine to Air Force personnel and ensure personnel receive such training early in their careers;
- Continue to enhance Air Force succession planning to ensure it is effective, transparent and well-understood by all Air Force personnel; and
- Develop a plan to measure and monitor the health and well being of Air Force personnel on a regular basis.



Air Reserves

Air Reserves (locations outlined at Annex E) support day-to-day operations and also provide a source of trained personnel to cater for increased operational tempo and shortfalls in the TES. Over the near to mid-term, the Air Force will:

- Maintain the current Air Force Reserve Model, including integrated Total Force establishments;
- Continue to employ Air Reserve aircrew where this is shown to be cost-effective using validated performance measurements;
- Implement defined performance goals for all Air Reserve personnel, based on experience using CFPAS Personnel Development Reviews (PDRs) to document agreed levels of Reservist availability and performance;
- Continue to refine the Air Reserve establishment as part of Projects Transform and Re-Balance; and
- Examine Reserve employment options associated with the Air Force Support Concept plus other future developments in such areas as Survival-to-Operate, Force Protection etc.

Distance and E-Learning Environment

The Air Force will create, in conjunction with broader CF efforts, a distance and e-learning environment to facilitate the training and education of Air Force personnel who are unable to attend centralized training and educational institutions. E-learning will complement more traditional 'first-hand' educational and training programs, which will continue to be very important.

Combat Capability



Aerospace Control Capability

Aerospace Control is a primary Air Force function that will continue to be required throughout the time period of the ACF. Major aerospace control initiatives include:

- Canadian NORAD Region (CANR) and Canadian Air Defence Sector (CADS) modernization;
- CF-18 modernization to include the acquisition of advanced air-to-air weapons;

- Domestic Airspace Surveillance Study;
- Main Operating Base (MOB) mobile air defence radar capability replacement;
- Incorporation of an air surveillance capability into the CP-140 Aurora as part of its transformation into an ISR aircraft; and
- Next Generation Fighter Capability.

Region/Sector Air Operations Centre (R/SAOC) Modernization

The Region and Sector Air Operations Centre (R/SAOC) Modernization Project aims to replace aging air sovereignty and air defence processing and display equipment and related communications equipment in the Canadian NORAD Region (CANR). Two options are being pursued: an interim Canadian solution based on NATO technology known as Multiple AEGIS Site Emulator Plus (MASE+); and a new U.S. solution currently being developed, the Battle Control System – Fixed (BCS-F). A decision on which system to acquire will be made in the 2004 timeframe. In either case, the system will be housed in a new above ground facility to be located in North Bay.

CF-18 Transformation

The CF-18 multi-role fighter currently constitutes Canada's only means of exercising active control and airborne air surveillance of unwanted activities in domestic and international airspace. Since Canada does not have a bomber force, the CF-18 is also Canada's primary air combat power projection capability. One hundred and thirty eight 1970s technology-based CF-18s entered service between 1982 and 1988.

Growth potential was an important factor in selection of the CF-18 as Canada's fighter aircraft and a mid-life modernization of the aircraft's systems was planned from the outset. In July 2000, the government authorized the modernization of 80 CF-18s. Detailed information on CF-18 fatigue life, Estimated Life Expectancy (ELE) and fleet size is contained in Annex H.

The expected assignment of the 80 aircraft fleet is as follows:

- 48 aircraft will be assigned to four operational squadrons. Based on an historical serviceability rate of 70%, this means that approximately 34 Mission Ready aircraft should be available at the start of each flying day;
- 17 aircraft will be assigned to the Operational Training Unit (OTU);
- 12 aircraft will normally be undergoing heavy (depot-level) maintenance;
- two aircraft will be assigned to the Aerospace Engineering Test Establishment (AETE); and
- one aircraft will be normally be assigned to the 10 Field Technical Training School (10 FTTS)

CF-18 modernization includes the following main elements:

- **Phase 1.** Mission Computer, Software, ECP 583 (Radar, radios, Combined Interrogator Transponder, Stores Management System), Displays, GPS, Night Vision Imaging System and Advanced Training Systems;
- **Phase 2.** Data Link, Defensive Electronic Warfare Suite, Helmet Mounted Display, and Flight Data Recorder; and
- **Weapons/Sensors.** Advanced Short and Medium Range Air-to-Air Missiles, Precision Guided Air-to-Surface Munitions and an Advanced Multi-Role Infrared Sensor.



U.S. Airforce Photo

The acquisition of new sensors, a helmet mounted display capability and advanced air-to-air weapons will transform capabilities inherent in the CF-18 and give it significantly improved battlespace awareness and enhanced engagement capabilities.

New Generation Fighter Capability (NGFC)

When the CF-18 reaches its ELE in 2017, it is expected there will still be a requirement for a manned fighter aircraft to conduct aerospace control and force application missions. Accordingly, the Air Force will form a New Generation Fighter Capability project office in the 2008 time frame, allowing selection of a replacement aircraft by 2011, placing of a contract by 2012 and initial deliveries by 2015. Changes to the CF-18 ELE could drive changes to the aforementioned dates. While future technological developments may provide additional options, aircraft currently foreseen as potential candidates are fifth generation fighters such as the F-22 Raptor (facing page, top) and the F-35 Joint Strike Fighter (facing page, bottom).


U.S. Airforce Photo

In general terms, a new generation fighter must:

- be highly maneuverable, capable of achieving supersonic speed and have significant range, endurance and acceleration capabilities;
- have onboard sensors capable of monitoring large volumes of airspace at long distances and the detection, identification, discrimination, designation, tracking and full-spectrum day, night and adverse weather engagement of multiple airborne targets;
- have an integrated situation awareness display capable of portraying air-to-air and air-to-surface targets and threats and communicating this information to other aircraft and surface-based forces;
- have long range jam resistant and secure communication and information systems, interoperable with other aerospace control elements;
- be capable of employing visual and beyond visual range (BVR) short and long range air-to-air weapons capable of autonomous guidance to airborne targets during the day, at night and in adverse weather conditions, complete with requisite stores carriage, management, release and fire control systems;
- be capable of employing precision and near-precision guided air-to-surface weapons capable of destroying targets on the ground during the day, at night and in adverse weather conditions;
- have accurate navigation and positioning systems;
- be fitted with laser, radar and missile approach warning systems;
- have stealth characteristics and adequate self protection capabilities such as chaff, flares and electronic jamming; and
- have an Air-to-Air Refuelling capability.


U.S. Airforce Photo

NGFC Project studies will result in the production of a specific Statement of Operational Requirements (SOR) that addresses these and other issues.

An Aurora ISR capability

C4ISR is a capability that is increasingly in demand. U.S. and allied experience in Operation ENDURING FREEDOM highlighted the need to collect, collate, and disseminate information quickly and provide the situational awareness needed for real-time targeting. Recent domestic operations such as Operation NOBLE EAGLE highlighted the need for a specific C4ISR element - air surveillance – to respond to situations such as the terrorist attacks of 11 September 2001. Airborne air surveillance aircraft were in short supply in the United States, prompting the U.S. to request support from NATO. Similarly, Canada asked the U.S. to provide such a capability in support of the G-8 summit in 2002.

To address the overall ISR requirement, the Air Force intends to pursue an evolutionary change to the CP-140 Aurora that will eventually result in revolutionary changes to its capability and role. The Aurora will be transformed from an ASW capable Long-Range Patrol Aircraft, currently focused on surface and subsurface surveillance of maritime areas, to a more flexible Intelligence, Surveillance and Reconnaissance (ISR) aircraft capable of air, surface (maritime and land) and subsurface surveillance, reconnaissance and intelligence collection. CP-140 squadrons will move from a predominantly maritime focus to a broader CF focus, with ability to contribute to air, land and maritime operations.

With an air surveillance capability, the Aurora would be able to directly contribute to the surveillance component of aerospace control (a primary operational function of the Air Force) as well as C4ISR force application (another primary Air Force function). Accordingly, an examination will be undertaken to establish the requirement and potential to incorporate this capability. In addition to technology issues, crew composition will need to be addressed – whether different crew compositions would be required to prosecute the air, surface and ASW missions or whether multi-role crews could effectively handle all three roles. Additional modernization beyond that currently planned through the Aurora Incremental Modernization Project (AIMP) would be required to add an air surveillance capability.

With an air surveillance capability, the Aurora would be able to directly contribute to the surveillance component of aerospace control.

Aerospace Force Application Capability

Aerospace Force Application is another primary Air Force function that will continue to be required throughout the time period of the ACF. Major initiatives include:

- Advanced Precision-Guided Munitions (PGM) for the CF-18 such as the Joint StandOFF Weapon (JSOW) and Joint Direct Attack Munition (JDAM); and
- StandOFF Air-to-Surface Weapons for the Aurora such as the Harpoon or SLAM-ER.



Contributing Aerospace Capability

The Air Force will continue to make direct contributions to naval, land and domestic operations. Major initiatives include:

- A new Maritime Helicopter; and
- An Electro-Optical Reconnaissance Surveillance and Target Acquisition Capability (ERSTA) for the Griffon Land Aviation Helicopter.

Maritime Helicopter Project (MHP)

The Sea King is currently Canada's only maritime helicopter. In December 2002, the Government announced it would proceed with plans to acquire a replacement helicopter for the Sea King. The fleet of 28 new Maritime Helicopters will support a structure of 11 HELAIRDETS, with aircraft assigned as follows:

- 15 operational 'at sea' to produce 11 HELAIRDETS;
- four shore-based helicopters for currency flying;

- three helicopters assigned to Operational Training;
- one helicopter for OT&E; and
- five helicopters in maintenance.

Representative candidates to replace the Sea King are shown below.



The new maritime helicopter will have the following contemporary capabilities:

- **Data Management and Sensors -** Imaging capable radar; acoustics system with a low to medium frequency tethered sonar and sonobuoy processor; ESM system; IFF/SIF; mission data management system; and Electro-Optical capability including full night vision integration;
- **Self Protection System -** Radar Warning Receiver, Counter-Measures Dispensing System, Missile Approach Warning System and General Purpose Machine Gun;
- **Communications System -** V/UHF capability to communicate on marine, voice and army bands; two beyond line of sight radios; secure and jam resistant communications capability; a direction finding capability for UHF and VHF; and datalink;
- **Navigation System -** Integrated GPS/INS;
- **Armament& Stores Control Capability -** Two weapons stations plus internal stores; and
- **Rescue Capability -** Hoist and vertical replenishment capability.

The CH-146 Griffon is Canada's only land aviation helicopter...

Transitional Synthetic Environment for MHP

A Transitional Synthetic Environment (TSE) is being developed to reduce the risk in transitioning from the technology of the Sea King to a contemporary technology maritime helicopter. TSE will be used to evaluate Operator Machine Interfaces (OMI), conduct proof of concepts studies, develop and validate procurement test plans, identify new crew procedures and conduct OT&E activities. Lessons learned from the use of TSE should be portable to other areas of the Air Force.

Griffon Transformation

The CH-146 Griffon is Canada's only land aviation helicopter, used primarily to provide direct aviation support to the Army. After discussion in 1990 between Mobile Force Command and Air Command, it was jointly agreed to provide aviation support to the Land Force with a single Utility Tactical Transport Helicopter (UTTH) fleet. The CH-146 Griffon, a militarized version of the Bell 412, was acquired for this purpose.

One hundred Griffons entered service between 1994 and 1998. The current ELE of the Griffon is 2020 and there are 98 aircraft still in service (two having been destroyed in accidents). Ten CH-146 are distributed among the three Combat Support Squadrons (Cold Lake, Bagotville and Goose Bay). Of the remaining 88 (including two at the Aerospace Engineering Test Establishment (AETE)), 86 directly and primarily support the Army. More detailed information on this fleet is contained at Annex H.



Planned Transformation

The Air Force currently plans to reduce the number of CH-146 Griffons supporting the Army from 88 to 75. These aircraft will be distributed as follows:

- 52 aircraft will be assigned to operational squadrons. Based on a serviceability rate of 67%, this means that approximately 35 Mission Ready helicopters should be available at the start of each flying day;
- 14 aircraft will be assigned to the Operational Training Unit (OTU);
- 7 aircraft will normally be undergoing heavy (depot-level) maintenance; and
- 2 aircraft will be assigned to AETE.

A significant number of modernization initiatives were undertaken subsequent to the acquisition of the commercial patterned Bell 412 Griffon helicopter. These include:

- **Fuel System -** Self-sealing, enhanced crashworthy features and hot cold circuit refuelling (HCCR) capability;
- **Navigation System -** Miniature airborne GPS receiver with P(Y) capability, Doppler radar and digital moving map display;
- **Communications System -** Secure voice system (KY58) for all radios, specific military ops intercom system, Sabre secure Police Band radios, HF radio with secure speech unit, avionics management system and two secure frequency-hopping radios interoperable with the land Tactical Command Control and Communication System (TCCCS);
- **NVG Capability -** Night Vision Goggle (NVG) compatible cockpit, cabin, navigation and formation lights and Heads Up Display (HUD), and NVGs for aviation flight engineers and air maintenance technicians;
- **Self Protection -** Ballistic protection for two pilot seats, chin bubble, cockpit and cabin floor panels, light machine guns for self protection for use by gunners positioned in the cargo door areas, Low IR signature exterior paint, defensive EW Systems (missile approach warning system, counter measures dispensing system and radar warning receiver with LWR capability), an Infrared Suppression System (IRSS), three outlets for crew NBCW suit plug-ins and provision to aircrew of a hand carried, non-tactical, personal locator beacon (PLB);
- **Other -** A-frame design Fast Rope and Rappel kits, external hoist for SAR missions, high intensity, selectable (white and IR light) searchlight, litter kits for casualty evacuation, narrow skid gear to facilitate transport by CC-130, air transportation kits, static wicks and

e Aurora constitutes anada's only long-range surface and subsurface surveillance aircraft.

dissipation system, secure cabinet and shelf units for equipment and cargo carriage; and

- **Sensors** - EO Westcam 16 inch single sensor with AGEMA FLIR and large FLIR monitors. An Electro-Optical Reconnaissance, Surveillance and Target Acquisition (ERSTA) capability (a multi-sensor turret with LLLTV, Thermal Imaging System, laser designator and range finder) with cabin control station and ground station for real-time data link is planned.

Requirements emanating from the "Army of Tomorrow" development will be addressed in a yet to be defined post 2010 mid-life upgrade for the Griffon.

Enabling Aerospace Capability

Aurora Transformation

The Aurora constitutes Canada's only long-range surface and subsurface surveillance aircraft. The aircraft entered service as a Maritime Patrol Aircraft (MPA) with an Anti-Submarine Warfare (ASW) focus. It is currently capable of employing a variety of sonobuoys to detect and localize submarines and a lightweight Mk 46 torpedo to prosecute them. The Air Force aims to extend the life of the CP-140 and, over time, transform it into an Intelligence Surveillance and Reconnaissance (ISR) aircraft with air, surface and sub-surface surveillance capabilities. Eighteen Auroras entered service between 1980 and 1981. The aircraft has an ELE of 2010, but it is planned to extend this to 2025. More detail on the ELE extension and issues associated with this fleet is contained at Annex H.

The Department currently plans to modernize 16 of 18 Auroras currently in inventory. The three Arctic and Maritime Surveillance Aircraft variants of the Aurora (known as the Arcturus and fitted with a radar set and long-range communications system) currently used for pilot training and surface surveillance will be retired when the new CP-140 Flight Deck Simulator (FDS) reaches full operational capability (FOC). The assignment of the CP-140 Auroras will be as follows:

- 11 aircraft will be assigned to operational squadrons. Based on an historical serviceability rate of 60%, this means that approximately 6-7 Mission Ready aircraft should be available at the start of each flying day;
- two aircraft will be assigned to the Operational Training Unit (OTU);
- two aircraft will normally be undergoing heavy (depot-level) maintenance; and
- one aircraft will be used for Operational Test and Evaluation (OT&E) on a part-time basis.

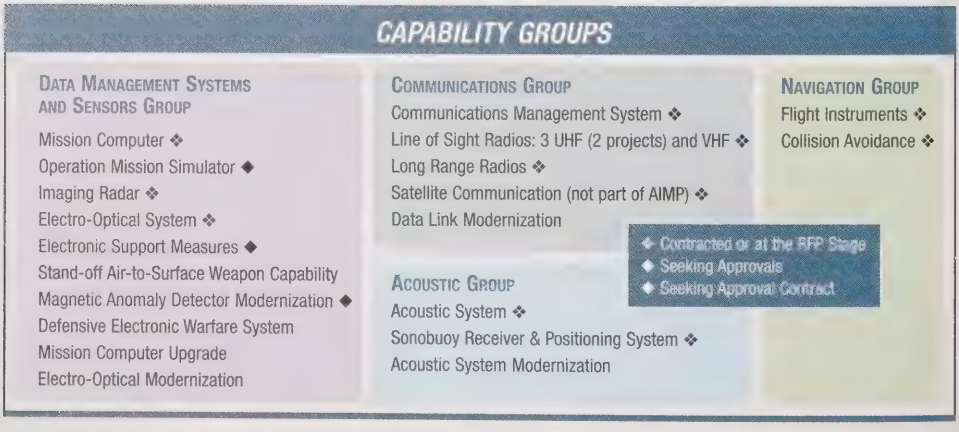
Planned Transformation

The Aurora Incremental Modernization Project (AIMP) will implement the majority of the changes necessary to transform the Aurora into an ISR platform, except for the air surveillance capability previously discussed in the aerospace control section. AIMP currently includes 23 incremental initiatives in five functional categories as noted below:

- **Data Management System & Sensors Group -** Mission Computer, Operational Mission Simulator, Radar, Electro-Optical (EO) system, Electronic Support Measures, Defensive Electronic Warfare System and Mission Computer upgrade;
- **Communication Group -** Communications Management System, Line of Sight Radios, Long-Range Radios, satellite communications and data link;
- **Navigation Group -** Flight instruments and collision avoidance;
- **Acoustic Group -** Acoustic system and Sonobuoy Receiver and Positioning System; and
- **Weapons -** Stand-Off Air-to-Surface weapon.

Aurora modernization is planned to occur in the following four blocks

- **Block I** - Legacy Projects;
- **Block II** - Navigation Capability Group;
- **Block III** - Communications Capability Group
  - DMS and Sensors Capability Group
  - Acoustic Capability Group; and
- **Block IV** - Upgrades



Aerospace Support Capability

The ability of the Air Force to continue to support and sustain national and international operations will be reliant on a variety of support capabilities. These include:

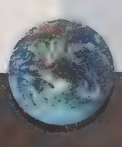
- Air Force Support Capability (AFSC);
- Air Force Command and Control Information System (AFCCIS);
- Air Force Support Vehicle (AFSV) Project; and
- Air Force Clothing Projects.

The Air Force Support Capability project aims to provide the unique Close Support (CS) and Integral Support (IS) required for deployed Air Force operations. IS comprises Aerospace Engineering and Maintenance (AEM) and logistics elements and is normally indigenous to a squadron. CS includes AEM, Logistics (Log), Airfield Engineering (AE), Communications and Information Services (CIS) and Military Police (MP) elements. AFSC aims to realign the Air Force support structure to enable more effective support to deployed operations.

The AFSC project will ensure sustainability by concentrating a large number of Log, AE and CIS military personnel in Mission Support Units (MSU) at Cold Lake, Bagotville, Greenwood and Trenton. AEM and MP forces, the other two functional areas included in this initiative, will remain in current locations and command structures. AEM forces will deploy with their respective units/aircraft to support operations.

The Air Force Command and Control Information System is a classified, operational system that will automate command and control processes within the Air Force. AFCCIS is also part of the CF Command System (CFCS) Family and, therefore, the Air Force contribution to the joint CF operational environment. AFCCIS will be delivered through the following four cycles:

- A classified network infrastructure to all Air Force operational locations (office automation, e-mail, web services and initial messaging capability). This cycle was completed in 2001;
- Acquisition of the USAF Theatre Battle Management Core System (TBMCS) to enable distribution of the Recognized Air Picture, Air Tasking Orders (ATOs) and Airspace Control Orders (ACOs). Interoperability with NORAD will also be completed in this cycle;
- Acquisition of additional hardware for Wings and Squadrons to provide them with enhanced situational awareness and decision-making tools; and
- Connectivity with additional external organizations to include departmental and corporate systems, primarily through CFCS followed by a re-baseline of the infrastructure.



The **Air Force Support Vehicle** project aims to replace Air Force ground vehicles. Some of these are high cost / low-density (HC/LD) special purpose vehicles used to directly sustain flying operations. Others are low cost / high-density (LC/HD) commercial pattern vehicles. This project will be advanced within the framework of a joint project.

Air Force clothing will be incrementally replaced and improved through the Clothing and Equipment – Millennium Standard (CEMS) project. It is an omnibus project that has 19 sub-projects.

C⁴ISR Sensors, Systems and ISTAR

The exploitation of information is a key element in the overall decision-making process. Raw data can be gathered, collated, processed and then presented in a form that conveys information and creates situational awareness. In most cases, such information will then be analyzed, interpreted and assessed to impart knowledge. Knowledge is normally combined with human factors such as experience, intuition, ingenuity and common sense to create the wisdom necessary for timely and effective decision-making. People will always play a vital role in this process, but increasingly, so will C⁴ISR sensors and systems.

C⁴ISR sensors and systems contribute to the decision-making process by gathering data and intelligence and by disseminating requisite information to create Situational Awareness (SA). Ideally, there should be a comprehensive joint, combined and inter-agency C⁴ISR system capable of gathering data and intelligence from multiple sensors, collating inputs and displaying fused information on real-time, three-dimensional Common Operating Pictures (COP) so that commanders and leaders can see and share information regarding the overall situation. The aerospace picture forms part of the COP. The Air Force is currently sponsoring a study intended to lead to recommendations for a comprehensive C⁴ISR architecture. It is also pursuing a datalink (Link 16) project for operational aircraft fleets.

The exploitation of information is a key element in the overall decision-making process.

When the collection and exploitation of intelligence is coordinated within the targeting process, this activity is known as Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR). The fusion of data may need to be complemented by analysis of commanders and staff to ensure that ISTAR resources are correctly employed, especially within the context of multinational operations.

C⁴ISR and ISTAR are important to contemporary operations. However, the acquisition of such systems can be extremely expensive and their operation very resource intensive. The production and promulgation of a comprehensive and coherent Departmental strategy and plan is required to ensure maximum capability is obtained for the minimum expenditure of resources.

Low Observable Technology

The operational benefits of low observable technologies were first demonstrated during the Gulf War. This is a technology that must be investigated for application to future combat-capable aircraft. It is expected that more R&D emphasis will also need to be placed on signature reduction in the radar, infra-red, acoustic, radio-frequency, magnetic and visual spectrums for operations in the 21st Century battlespace.

Uninhabited Air Vehicles (UAV) and Remotely Piloted Aircraft (RPA)

The Uninhabited Air Vehicle (UAV) is a technology area that can make important contributions to Air Force aerospace power capabilities. The Uninhabited Air Combat Vehicle (UCAV) is a remotely piloted aircraft (RPA) variant. RPA are those where a pilot is required and pilot actions are necessary for effective remote operations such as delivering weapons and putting aircraft on target.



U.S. Airforce Photo

Although UAVs have played (and will continue to play) an important role in modern conflict, it is also expected that the production of aerospace power in the future will continue to require a combination of manned and unmanned platforms.

A UAV study is currently underway within the Canadian Forces Experimentation Centre to examine potential applications for these vehicles. UAVs and their current practical limitations are covered further in this document under the UAV study section.

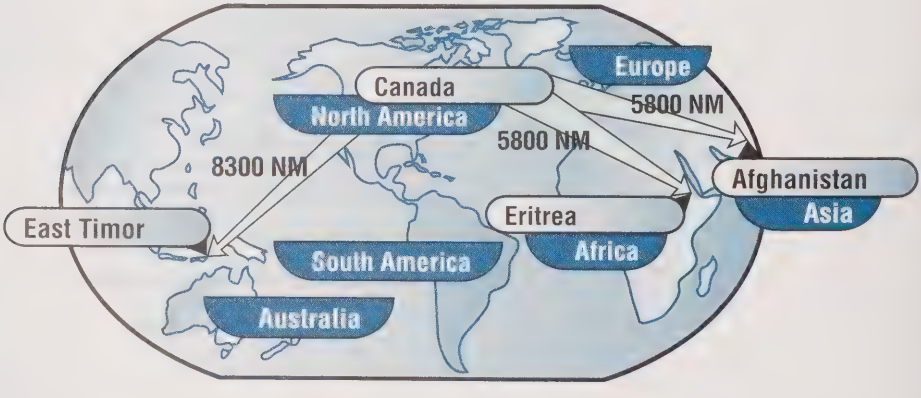
Reach and Power

Airlift

As previously discussed, reach includes the ability to move equipment, supplies and personnel to, from, between and within intended theatres of operation. Options available may include transport by ground, sea and air. Of these options, transport by air is normally the most expeditious option, especially when long distances are involved. For Canada, a country whose geographical area is the second largest in the world and comprises many large remote areas, this option may be the only one available under many circumstances.

Transport by air is one of only two options available when forces must be moved overseas to participate in operations. The transport of personnel, equipment and cargo by air involves the use of airlift aircraft that perform the following two distinct functions:

- **Inter-theatre Airlift -** involves transport by air to, from and between theatres of operation. These flights are normally flown at relatively high subsonic speed and high altitude because of the long distances involved (East Timor, Eritrea and Afghanistan being between 5800 nm and 8300 nm from Canada, for example); and



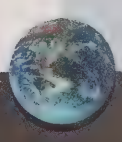
- **Intra-theatre airlift -** involves transport by air within theatres of operation.

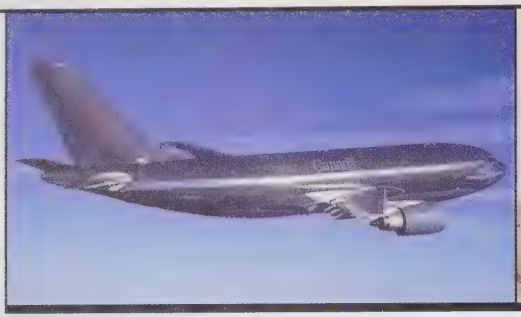
Airlift operations are subject to a number of constraints that include:

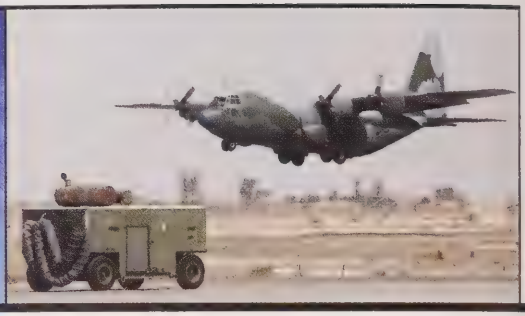
- **Airspace access -** Access may require military communication, navigation, approach, identification and self-protection capabilities, especially if the airfield is within or near an area of conflict;
- **Airfield access -** Access may involve landing on (and subsequently taking off from) short, narrow and unprepared (unpaved) runways. Factors such as crew day limitations, loads and overnight ramp space at the Airport of Disembarkation (AOD) may require establishing Airlift Control Elements (ALCEs) en route, to permit the efficient and expeditious deployment of forces into theatres of operation;
- **Airfield operations -** Airfields may have limited approach aid capabilities and, therefore, weather limitations may restrict flying operations. As well, there may be limited capability to off-load, service and load aircraft; and
- **Airspace restrictions -** Restrictions exist in many parts of the world. For example, the North Atlantic Tracks System (NATS) exists within Minimum Navigation Performance Specifications (MNPS) airspace between Canada and Europe above flight level 270. Some aircraft may be precluded from flying in this airspace because of slower flying speeds or certification issues. Similar airspace structures and restrictions exist in other areas of the world.

Canada currently has three types of airlift aircraft in service:

- **CC-150 Polaris (Airbus 310-304) -** A commercial patterned passenger airlift aircraft, the CC-150 can fly at a speed of Mach 0.8 over approximately 5,000 nautical miles at altitudes ranging from 29,000 to 41,000 feet. While the CC-150 provides excellent capability to transport personnel and cargo, it is not capable of operating from other than paved runways, requires a minimum runway length of 7,000 feet, requires special handling equipment to load and off-load cargo and is not capable of air dropping equipment or supplies. The Polaris routinely operates in airspace structures such as NATS airspace while en route to Europe from Canada. The aircraft has been modified to carry passengers and/or cargo in one of the three configurations listed below:
  - — Passenger - 194 personnel;
  - — Combi - a total of 68,000 pounds of freight comprising up to 60 personnel, 12 (108 X 88 inch) pallets in the upper deck and cargo in the lower deck; or
  - — Freight - a total of 72,000 pounds of freight comprising up to 14 (125 X 88 inch) pallets in the upper deck and cargo in the lower deck.







- **CC-130 Hercules (E and H Models) -** The CC-130 Hercules is a smaller military patterned airlift aircraft (shown above right). The CC-130's transit speed varies between 280 and 330 knots while transit altitudes vary from 14,000 to 33,000 feet. Minimum runway length requirements are based on Critical Field Length (CFL) calculations (4400 feet being representative of a fully loaded E-model) and the runway surface must support the predicted maximum aircraft weight. It is capable of air dropping equipment and supplies. When fully loaded with fuel and cargo, the Hercules is generally restricted from operating in NATS and similar airspace because of its slower flying speed, with adverse impacts on operating efficiency over longer flying distances. In its fully loaded configuration, the CC-130 can carry fuel and cargo loads between:
  - 10,000 pounds of freight for approximately 3700 nautical miles when fully loaded with fuel (63,000 pounds of fuel with external fuel tanks); and
  - 47,000 pounds of freight for approximately 1100 nautical miles when minimally loaded with fuel (26,000 pounds).
- **CC-144 Challenger -** The CC-144 Challenger is a twin-engine business-jet type aircraft. The Air Force has six CC-144s, four of which provide VIP airlift support to the government and two that provide utility transport for the CF.

Airlift Capability Project (ACP)

The Airlift Capability Project (ACP) aims to acquire a replacement capability for the current CC-130 E and H aircraft. A variety of options will be investigated to include contracted services, lease, lease to buy, purchase or potential 'teaming' arrangements. While requirements are being defined, a number of issues, including the requirement for dependable and assured access to airlift resources, will need to be addressed.

The Canadian Forces generally has some latitude in how quickly personnel, materiel and equipment must e transported to a theatre.

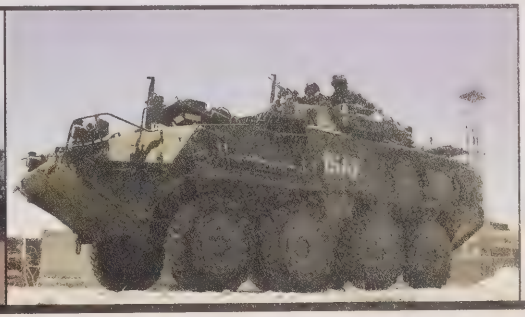
The Canadian Forces generally has some latitude in how quickly personnel, materiel and equipment must be transported to a theatre. However, in some circumstances (for example, the need to rapidly evacuate people from a combat zone or respond to a natural disaster) this flexibility can be very limited.

To determine 'best value', the ACP will examine options that range from the status quo, replacement of the CC-130 with like capability or replacement of the Hercules with an aircraft with the capacity to carry outsized cargo.

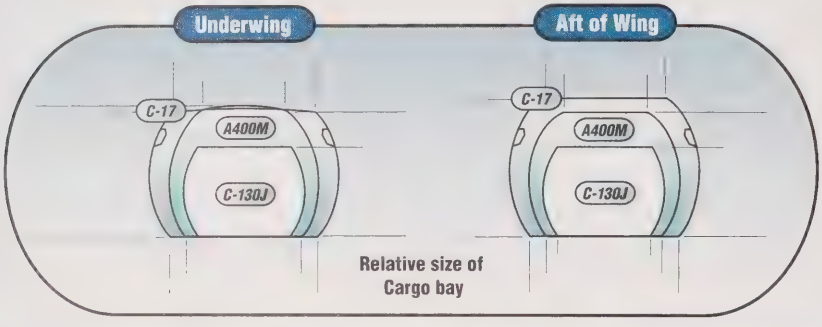
Outsized Cargo

Prior to developing a Statement of Operational Requirement (SOR) for the ACP, the CF will need to determine what requirement exists to transport outsized cargo and whether this transport needs to be done by the Air Force or can be contracted over the long term. Outsized cargo is defined as cargo that, because of length, width, height and/or weight, cannot fit into a Hercules-sized aircraft. Such cargo includes equipment such as the HLVW used by the Disaster Assistance Response Team (DART) (shown below left); the Beaver Tail Trailer; 6K and 5K forklifts; and the 6X4 Dump Truck. Other equipment, such as the Army's LAV III (shown below right), must be disassembled to enable transport by Hercules. Three Hercules flights are required to transport two LAV III vehicles.



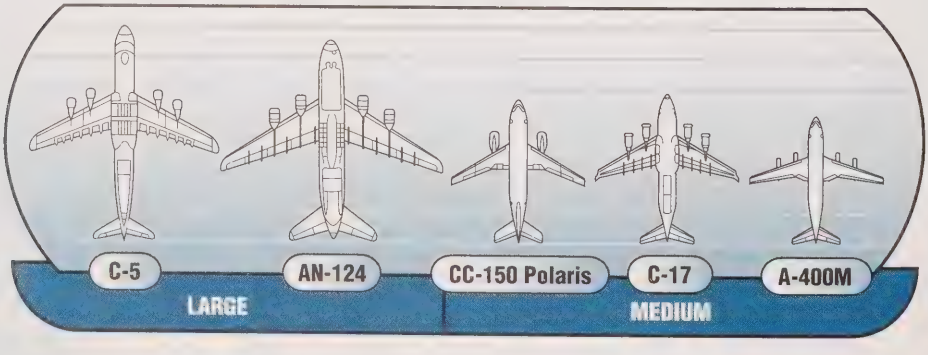


The following diagram illustrates the relative cross sectional sizes of two aircraft with the capacity for outsized cargo (the C-17 (photo below left) shown in blue and the A400 (photo below right) shown in green) along with the cross section of C-130J (which cannot carry outsized cargo).





The external dimensions of various airlift aircraft (including the CC-150 Polaris) are shown to scale in the following diagram.



Deployed Operations Capability

To meet its global deployment requirement, the Air Force must be prepared to deploy to and operate from main operating bases (MOB), deployed operating bases (DOB) and potentially bare bases (BB). The most austere of these locations is the bare base airfield. Operations from such airfields require, as a minimum, the capabilities listed below. These minimum capabilities may be provided by the deploying nation, the host nation or both (as agreed and negotiated prior to the deployment).

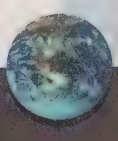
- Runway sweepers;
- Aircraft fuel storage;
- Water supply and storage;
- Munitions storage (if required);
- Power for critical facilities;
- Airfield lighting;
- Aircraft ground handling equipment;
- CFR crews and equipment;
- Secure communications for receiving tasking and intelligence information;
- ATC (tower and approach aid) equipment;
- Arresting gear (for fighter operations);
- Wing and squadron operations facilities;
- Aircraft maintenance facilities;
- Gas and fluid supply and storage; and
- Lines of communication capable of re-supply.

Specific aircraft maintenance equipment is also needed to support deployed operations. This includes such things as mobility containers, portable test sets and spares provisioning kits.

Survive To Operate (STO) and Survive To Evacuate (STE)

During the Cold War, Canadian Air Force units stationed in Europe were among the most capable in NATO in dealing with potential attacks with chemical, biological or high-explosive munitions. NATO standards for 'Survive To Operate' (STO) required bases be equipped with protected command and control facilities and personnel bunkers; and aircrew and ground crew were provided protective clothing and other equipment needed to survive and recover from an attack and then continue operations, even under contaminated conditions.

With a reduced threat following the end of the Cold War – and given financial and other constraints – Air Force STO capabilities were allowed to atrophy during the 1990s. However, the rise of global terrorism and the continued proliferation of weapons of mass destruction require renewed emphasis on Chemical, Biological, Radiological, Nuclear or high yield Explosive (CBRNE) response capabilities.



The reconstitution of STO capabilities within the Air Force will be coordinated with similar initiatives within the Joint Staff, focusing initially on ensuring selected units are capable of 'Survive To Evacuate' (STE). STE – which is clearly less robust and demanding than STO – requires the ability to survive a CBRNE attack on the ground and, if necessary, effectively evacuate the area. Under the STE concept, forces will only return to an area after the CBRNE threat has been eliminated. Airborne aircraft will normally be diverted from affected airfields to nearby bases. If aircraft are forced to land (due to fuel considerations, for example) means must be available to permit aircrew to deplane and survive until evacuated. Unlike under the STO concept, units will not be expected to conduct operations in or from a contaminated environment.

The Air Force's STE capability will be developed incrementally, starting with those forces most likely at risk. Priority will be given to CF-18, CH-146 and CC-130 units. Maritime helicopter units will train for and maintain capabilities consistent with the requirements specified for the ships on which they deploy.

Resource constraints will continue to require close coordination with the Joint Staff and the Army and Navy to avoid duplication. Work will also be required to ensure an appropriate level of compliance with NATO standards and interoperability with key allies (particularly the United States).

Additional Projects, Initiatives and Studies

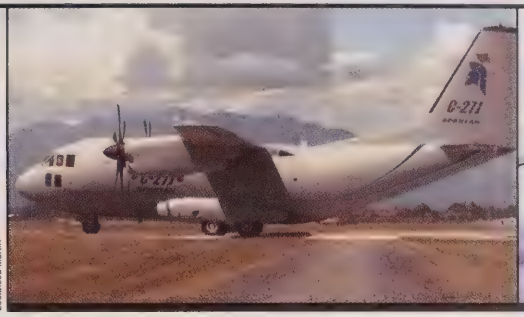
Fixed Wing SAR (FWSAR) Aircraft

Canada currently operates six CC-115 Buffalo, seven CC-130 Hercules aircraft and 15 CH-149 Cormorant helicopters to carry out the SAR mission. Fixed-Wing SAR (FWSAR) aircraft are needed for timely and speedy response to distress cases within the 15.5 million square kilometre Canadian area of responsibility.

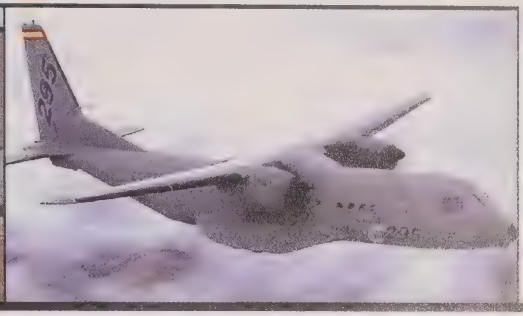
The Air Force's STE capability will be developed incrementally...

The extended range of FWSAR aircraft, their ability to stay on station and their speed allow them to provide a search capability far greater than helicopters, especially in adverse weather conditions, in more remote areas and in oceanic and arctic scenarios. FWSAR aircraft are used to deploy SAR Technicians and survival equipment to provide primary assistance to survivors in distress. Once helicopters arrive on the scene to execute a rescue, FWSAR aircraft are used to provide 'top-cover' for communications, support and coordination.

Original plans called for the retirement of the Buffalo one year after the Cormorant entered service. In December 2002, the Department directed an extension of the Buffalo until 2010, to allow time to examine options to replace all FWSAR aircraft with a more modern and efficient aircraft. The photos below are representative examples of aircraft that could fulfil this role.



Lockheed Martin



Lockheed Martin

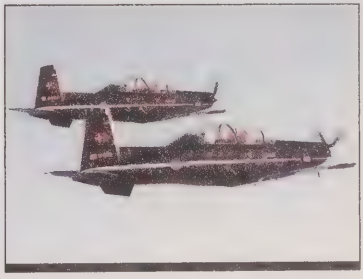
Combat Support and Utility Aircraft

No significant near term modernization is planned for the ten Ch-146 Griffon helicopters distributed among Cold Lake, Bagotville and Goose Bay. However, CSS capabilities will be examined in the Air Force's CSAR study and the future of CSS at Goose Bay will be reviewed as part of ongoing discussions with Allies.

There are four CC-138 Twin Otters (ELE of 2005 with 2010 under study) in the Air Force inventory, used to provide support to Northern Region. The future of these aircraft will be examined over the longer-term, once the future of ACP and FWSAR is clearer.

Contracted Flying Training

The current CFTS contract expires in 2005 and the NFTC contract is valid until 2021. Both of these contracts will need to be revalidated in due course.



Air Demonstration Fleet

The Snowbird Air Demonstration Team currently flies the CT-114 Tutor aircraft (ELE 2010 with potential for extension to 2020). The timing of a replacement aircraft will be determined over the next few years.

Science and Technology

Air Force capabilities are highly dependent on technology. The exploitation of new technology undertaken at the beginning of the transformation period could result in a significant enhancement of capabilities later on in the period. The ACF priorities for S&T are as follows:

- Three dimensional virtual reality real time situation awareness displays;
- The display of sensor data in real time on virtual reality 3-D displays;
- Situation awareness data transmission and display;
- Wide area aerospace surveillance systems capable of small target detection;
- Airborne target detection, sorting, identification and tracking;
- Surface target detection, sorting, identification and tracking;
- Sub-surface target detection, sorting, identification and tracking;
- Threat detection, classification, warning and protection for aircraft;
- Multi-spectral signature reduction;
- Airborne sensor systems with day, night and adverse weather capability;
- Advanced aerospace propulsion systems;
- Advanced life support and survival systems; and
- Virtual reality training in a linked synthetic environment.

Operations Research

The priority of Air Force operations research will be the development of:

- Operational Research Tools to support force development activities with sufficient fidelity to create and modify aircraft and personnel establishments (ASTRA, EnRAM and REVAMP);
- Models to aid in air mission operational rehearsals; and
- Models to aid in air program acquisition activity.

Test and Evaluation (T&E)

Test and Evaluation (both Engineering Test and Evaluation [ET&E] and Operational Test and Evaluation [OT&E]) will continue to be an important enabler for many of the equipment modernization initiatives essential to Air Force transformation. The organizations that execute Air Force T&E are listed at annex C.

Air Maintenance

The Air Force mission is directly tied to the application of aerospace power across a spectrum of activity and conflict. For the Air Force to execute its mission while also discharging operational and airworthiness responsibilities, it must generate MR aircraft to meet force generation and force employment requirements.

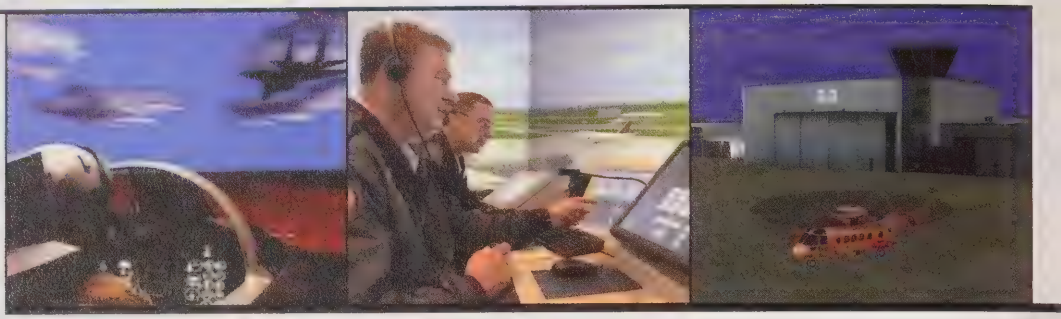
The Aeronautics Act requires the Air Force publish appropriate orders and directives that govern air maintenance. These include Canadian Force Technical Orders (CFTOs) that specify how Aerospace Engineering and Maintenance (AEM) engineers and technicians must be trained, qualified and authorized to generate airworthy MR aircraft through a combination of engineering activity and corrective and preventative air maintenance. Canadian Forces Airworthiness policy is established in the Technical Airworthiness Manual (TAM).

Air Maintenance involves a combination of military and contracted activity. For Air Force units tasked to deploy to potentially hazardous theatres of operation, military or 'blue-suit' air maintenance (supported by industry within Canada) will be required to meet assigned deployment requirements and force generation activities. The Air Force uses a 3:1 force generation to force employment ratio for personnel. This means that for every military person deployed, there must be at least three non-deployed people to sustain operations. Military air maintenance will be required for fighter, long-range patrol, land aviation and maritime helicopter aircraft. Depending on aircraft type and intended concept of operations, military air maintenance may also be required for air mobility aircraft.

For Air Force units that do not have a requirement to operate from deployed situations within a theatre of operations, other arrangements may be considered. For such organizations, operational effectiveness and best value will determine the most appropriate maintenance arrangements.

Combat operations may involve situations that preclude the conduct of normal air maintenance. When these situations occur, a Contingency Aircraft Maintenance Program (CAMP) will be instituted. CAMP includes abbreviated maintenance schedules and inspections as well as rapid repair procedures.

Aircraft Battle Damage Repair (ABDR) is an element of CAMP. ABDR involves the expeditious repair of aircraft damaged during combat when normal repair methods are impractical for reasons such as battle tempo and inadequate communications. The technological complexity of modern aircraft combined with the lethality of modern weapon systems limit the number of situations where ABDR would be used in lieu of ferrying aircraft out of the theatre of operations to effect repairs. The current ABDR program will be redefined and elements of the existing training program integrated into existing technical training for the CF-18 and CH-146 fleets. An examination will also be undertaken to determine if such a capability is required for the CC-130 fleet. No other fleets will maintain an ABDR capability.



Synthetic Environment

The creation and maintenance of a synthetic environment for simulation and training activity is viewed as an important element of Canada's future transformed Air Force. The synthetic capability could have important application in other areas such as concept development, requirements definition, operational mission rehearsal, experimentation, acquisition and operational test and evaluation. While this capability will not replace first-hand spatial and temporal experience (including flying), it will complement existing capabilities so that overall effectiveness and efficiency is enhanced.

Air Regulatory Projects

The following air regulatory projects are currently being pursued:

- Military Automated Air Traffic System (MAATS);
- Global Positioning System (GPS);
- Aerodrome Precision Approach Landing System (APALS);
- Area Surveillance Radar / Secondary Surveillance Radar (ASR/SSR); and
- Mode S.

The **MAATS** project aims to replace the existing manual Air Traffic System (ATS) with automated equipment and a distributed flight planning service. It will also provide access to the National Flight Data System so that the Canadian Forces ATS will remain compatible with the Canadian Automated Air Traffic System (CAATS).

The **GPS** project aims to acquire en route navigation, terminal, non-precision and precision approach GPS receivers and associated equipment for CF aircraft. It also aims to address GPS vulnerabilities to jamming.

The foundations of AFPM are the Air Force rategy map and balanced scorecard framework.

The **APALS** project aims to acquire a precision approach and landing system for Cold Lake, Goose Bay, Shearwater, Greenwood, Comox, Trenton and Bagotville. These systems will replace current Precision Approach Padar (PAR) capabilities.

The **ASR/SSR** project aims to ensure continued terminal radar services in military airspace after current ASR/SSR capabilities reach their end-life.

The **Mode S** project aims to acquire mode S to allow CF aircraft fleets to operate in European civil air route structures. It will also acquire Mode-5 transponder equipment to enable aircraft to comply with NATO combat ID requirements.

Infrastructure

An Air Force infrastructure plan will be developed to optimize the infrastructure footprint associated with the 13 Air Force Wings (discussed at Annex D) across the country. As well, a reinvestment and re-capitalization plan will be developed, to include a plan for Air Force historical sites (including those designated as national heritage sites).

Air Force infrastructure plans will aim to eliminate risks to people, provide conformity to government standards and reduce risk to the department. The Air Force aims to manage all hazardous materials responsibly, minimize the consumption of non-renewable resources, minimize sources for introducing pollutants into the environment and plan military and non-military activities on land and marine holdings such that adverse effects on habitats are minimized.

Performance Management

The Air Force has recently undertaken efforts to design and implement Air Force Performance Management (AFPM) as a modern planning, reporting and communications tool. Performance management includes both business planning and performance measurement. AFPM will be comprised of core management processes linking strategic planning to current operations, ongoing force generation activities, force modernization and force change activities – to ensure the Air Force maintains relevance and credibility.

The foundations of AFPM are the Air Force strategy map and balanced scorecard framework. The strategy map sets out Air Force strategic objectives as they relate to core activities and processes. It also establishes the quarterly and annual reporting frameworks that provide both a navigational view (for in-year decision-making regarding force generation and sustainment); and an evaluative view

(for strategic management of modernization and force evolution). The balanced scorecard depicts the Air Force mission and vision from four key perspectives: personnel development; internal processes; finances; and resources. It also depicts outputs, Air Force capabilities delivered to the Government and people of Canada. Thus, the strategy map and balanced scorecard communicate and explain the Air Force mission and vision as well as the Chief of Air Staff's priorities, present and future. When fully functioning, AFPM will serve as a powerful tool to assist the Air Force achieve yearly and longer-range goals and engender a more cohesive and focused organization.

Contracted Force Generation (CFG)

There was a need for Air Force operational oversight on contracts that either directly provide the Air Force with capabilities or have a direct impact on Air Force organizations. A Directorate of Air Contracted Force Generation (D Air CFG) was established within the Air Staff reporting directly to the Assistant Chief of the Air Staff. D Air CFG is responsible for NATO Flying Training in Canada (NFTC), Canadian Flying Training System (CFTS) and Contracted Airborne Training System (CATS) contracts as well as the Goose Bay Multi-National MOU (MMOU). The new Directorate will be given Project Director (PD) responsibility in each of these and similar future areas.

Capability-Based Costing

The Department's move to capability-based planning will need to be accompanied by a similar move to capability-based costing. However, to do this will require agreement on methodologies and accepted measures of comparison. By way of illustration, as part of Defence Update work in 2002, DGSP staff compared the costs of a CF-18 Squadron, a Canadian Patrol Frigate and an Infantry Battalion. While interesting, such comparisons may be misleading. Based on combat power, for example, it could be argued a single CF-18 fully loaded with PGMs is more powerful than an entire Infantry battalion and therefore the cost of one aircraft, not a squadron's worth, should be compared. On the other hand, for certain missions (peace keeping or peace enforcement, for example) the Infantry battalion would be essential to success. Furthermore, since Air Force capabilities such as maritime helicopters and tactical aviation are considered to be organic assets (from an operational perspective), for accounting purposes the cost of these capabilities should be included in the cost of the capability to which they contribute.

Cost comparisons should also take into account force employment as well as force generation costs. For example, the table below represents a theoretical joint operational deployment of land, sea and air units for operations. The figures shown are not meant to be absolute. However, they are presented to show issues must be resolved if accurate comparisons are to be made regarding capability costs and old paradigms will need to be challenged and replaced with logical and accurate assessments.

	Personnel	Full Cost ($M)	Incremental Cost ($M)
CF 18 12 pack[1]	200	202.5	13.7
IRF(L) & SLOC[2]	896	208.0	150.5
Naval Task Force[3]	1119	217.4	32.4

Notes: [1] The CF-18 element is based on experience during Op ECHO when aircraft were based in Aviano, Italy.
[2] The land example is based on the Op APOLLO deployment to Afghanistan in 2002. SLOC refers to a strategic Sea Lines of Communication supply base located in the region.
[3] The maritime example is based on the Op APOLLO deployment of ships to the Gulf of Oman. The Task Force is comprised of two FFH, one DDG and one AOR.

Miscellaneous Requirements (MR)

A Miscellaneous Requirement (MR) is defined as a project for the one-time acquisition of new equipment, materiel and/or services where the total project value does not exceed $3M or for the recurring acquisition of replacement equipment and materiel where the individual item value does not exceed $1M. Further conditions applicable to MR projects are: they do not significantly increase demand on Personnel or O&M; they have no associated project management costs; and they have no associated project definition/development costs. Each year, the Air Force produces an Integrated and Prioritized Requirements List (IPMRL) and uses this list to determine which MR projects will be funded. While individually important, projects on the IPRML are not detailed in the ACF because of their large number and small total value.

Goose Bay MMOU

The Goose Bay Departmental Multinational MOU (MMOU) expires on 31 March 2005. Significant effort is underway within the Air Staff to work with other stakeholders on the following key areas:

- Effectiveness – successfully fulfilling new allied training requirements such as supersonic flight to 60,000 feet, more night flying, use of flares and chaff, etc;
- Efficiency – reducing costs to allies and DND while introducing an improved fee structure and business model; and
- Marketing – improving marketing, in partnership with other federal government departments and the province.

Air Force Studies

It is often necessary to carry out preliminary studies before proceeding with action to address deficiencies or improve effectiveness and efficiency. Some of the studies to be carried out by the Air Force over the near term are as follows:

- Domestic Air Surveillance;
- Air Force Operational Capability (AFOC);
- C4ISR;
- Aurora Weapon Employment;
- CSAR;
- Contracted Aircraft Maintenance Support;
- Out of Country Positions;
- MOC 169/170 rationalization;
- AETE T33 requirement;
- Application of UAV Capability to Air Force Operations;
- Application of Space Capability to Air Force Operations; and
- Knowledge Management.

Domestic Air Surveillance Study

Prior to the terrorist attacks of 11 September 2001 against the United States, in terms of surveillance, the Canadian NORAD region was primarily focused on the approaches to national airspace. Shortly thereafter, a study was initiated to examine national military air surveillance requirements. The study needs to be coordinated with NAV CANADA and the Office of Public Safety and Emergency Preparedness (PSEP) and the final product provided to the bi-national North American Air Surveillance Council (NAASC). This study will address all aspects of future surveillance capability including that currently provided by the North Warning System (NWS) Radars.

This study will address all aspects of future surveillance capability...

Air Force Operations Capability (AFOC) Study

When an operational unit is sent on deployed operations, there is normally a command and operations element that also needs to be deployed. The command element is normally selected from among senior personnel serving in positions with full time responsibilities. Personnel to serve in operations centres are similarly chosen. The result is that senior Air Force positions are

vacant for some period of time, with personnel appointed to fill in. This is not an ideal construct because it leaves key positions (such as Wing Commanders) occupied by subordinates for extended periods of time. A study will investigate other options.

C4ISR Study

There are a significant number of Departmental initiatives related to C4ISR. It will be important for the Air Force to rationalize its initiatives with those of others in the Department in order to establish a logical and coherent way ahead in this capability area. The Air Force C4ISR study will identify all Air Force C4ISR capabilities and how these relate to Departmental initiatives. Other issues such as GMTI and AMTI will also be addressed in the study. More specifically, the study will produce a concept of employment for use of the Aurora as an ISR platform in all three mediums (air, surface and sub-surface). The issue of designating the aircraft as a High Demand/Low Density (HD/LD) aircraft (once so equipped) and what that designation means will also be examined.

Aurora Weapon Employment Study

The development of a concept of employment is a necessary next step in progressing an initiative to acquire a stand off air-to-surface weapons capability for the Aurora. The concept should examine both a land attack and naval attack capability.

Combat Search and Rescue (SAR) study

A study will be undertaken to examine options for a Canadian CSAR capability. This study will examine options ranging from acquisition of capabilities that allow Canadian aircrew to utilize Allied CSAR resources to modification of a limited number of existing aircraft to carry out the CSAR mission.

Contracted Aircraft Maintenance Study

A study will be undertaken to determine whether or not we are getting value for money in areas such as contracted maintenance for the Cormorant fleet. This study will be undertaken in conjunction with the ADM (Mat) staff.

Out of Country Position Study

A study will be undertaken to review the relevance and value of all Air Force positions outside Canada (see Annex G). This review will be coordinated with appropriate DCDS, VCDS and HR-Mil staff.

MOC 169/170 rationalization

A rationalization will be undertaken of the 169/170 MOCs within the context of the APALS project.

AETE T33 Study

A study will be undertaken to examine the need to continue to fly the T33 at AETE. This study will be conducted in conjunction with ADM (Mat) and AETE.

UAV Study

A study will be undertaken to examine potential Air Force/CF applications for UAVs. The study will pay due regard to operational advantages and practical limitations associated with such vehicles and make recommendations regarding potential concepts of employment and capability options. The Air Force UAV study will examine potential applications for UAVs and RPAs and determine requirements in areas such as:

- Line of sight (LOS) and beyond line of sight (BLOS) capability;
- Speed, altitude and Air-to-Air Refueling (AAR) capability;
- Deployability to, from and within theatres of operation;
- Air-to-surface and Air-to-Air sensor capabilities;
- Sensor range, field of view, persistence, night and adverse weather capabilities;
- Ability to react to unexpected events while airborne;
- Survivability;
- Personnel requirements to launch, operate, recover, maintain, configure and support platforms, sensors and communication systems;
- Airspace control, flight planning and collision avoidance;
- Operator, sensor, analyst, maintenance, payload, command and control, airspace control and support personnel training; and
- Cost.

Space Study

A study will be undertaken to examine how space will likely affect aerospace operations in the horizon two and three time periods. This study will make recommendations on specific initiatives necessary to realize the vision articulated in the ACF (to include doctrine and concept development).

Knowledge Management

Knowledge management is another area of interest to the Air Force. The turnover of military personnel often results in knowledge gaps in individual positions. There is a need to capture and retain this knowledge as personnel rotate through positions to ensure that lessons learned, historical information (data, events and circumstances), methods and their underlying rationale are all retained for the benefit of others. An examination will be undertaken on how best to do this.



Annex A

Comparison of 1989 and Early 21st Century Air Forces

1989 Air Force	Early 21st Century Air Force
Fighters 138 CF18 Multi-Role (96 operational) 43 CF 5	**Fighters** 80 CF18 Multi-Role (48 operational)
Patrol Aircraft 18 CP140 Aurora LRPA 3 CP140A Arcturus 19 CP121 Tracker MRPA	**Patrol Aircraft** 16 CP140 Aurora LRPA
Maritime Helicopter 33 CH124 Sea-King	**Maritime Helicopter** 29 CH124 Sea-King (28 new MH)
Land Aviation 7 CH147 Chinook Heavy Lift Helicopter 44 CH135 Medium Transport Helicopter 63 CH136 Light Observation Helicopter	**Land Aviation** 75 CH146 Griffon
Air Transport / AAR 5 CC137 Boeing 707 (2 AAR) 28 CC130 Hercules 10 CC144 Challenger 2 CT142 Dash 8 7 CC109 Cosmopolitan	**Air Transport / AAR** 5 CC150 Polaris (2 AAR) 32 CC130 Hercules (5 AAR) 6 CC144 Challenger (4govt/2mil)
SAR 14 CH113 Labrador Helicopter 15 CC115 Buffalo Fixed-Wing Aircraft	**SAR** 15 CH149 Cormorant Helicopter 6 CC115 Buffalo (then new FWSAR)
Combat Support 9 CH118 Iroquois Helicopters 6 CE144 EW Challenger 42 CT133 (ST, EW, DM)	**Combat Support** 10 CH146 Griffon Helicopters 4 CT 133 (AETE)
Training/Utility 22 CT 134A Muskateer II 9 CH136 Kiowa 136 CT144 Tutor (pilot training and Snowbirds) 4 Dash 8 (navigator training) 7 Twin Otter	**Training/Utility** CFTS contract* NFTC contract* 17 CT144 Tutor (Snowbirds) 4 Dash 8 (navigator training) 4 Twin Otter

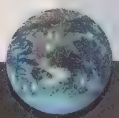
* CF pilot training currently being executed through the CFTS and NFTC contracts

Total	1989	FY 93/94	FY 02/03	% Reduction
Military personnel	24,113		12,566	48
Civilian FTE	6,980		2,178	69
Aircraft	684		303	56 (45)[1]
YFR (hours)	294,124		120,465	59
Operating Budget[3]		$586.2M CY ($724M in $02/03)[2]	$450.6M (Vote 1)	38
National Procurement[3]		$765.7M CY ($946M in $02/03)[2]	$605M	36
Ammunition		$56M CY	$44M ($69M)	36

Note 1. CFTS currently provides Phase I, phase III helicopter and phase III multi-engine training with 12 T67 Slingsby Firefly (contractor owned), 13 CH139 Jet Ranger (DND owned and provided to the contractor and civil-registered) and 8 C90A King Air (contractor owned) aircraft respectively. NFTC provides Phase II with 24 CT156 Harvard II (DND leased) and Phases III and IV with 18 CT155 Hawk (DND leased) aircraft. There are currently 75 aircraft associated with CFTS And NFTC. For comparison purposes if these aircraft were added to the total aircraft in Air Force inventory, the overall reduction is 45%. Not all NFTC aircraft, however, are used to satisfy Canadian training requirements.

Note 2. FY 02/03 figures were changed from Constant Year (CY) to Budget Year (BY) dollar amounts in order to enable an accurate comparison with the FY 93/94 figures.

Note 3. DGAEPM allocations are inclusive of COLOG and publications, but exclusive of ammunition and sonobuoys. NP was not apportioned among the CCs prior to FY 93/94, therefore, that year was used for comparison purposes.



Annex B

Air Force Training

Air Force training currently takes place at the following locations:

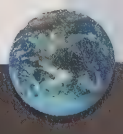
- Phase I pilot training through the CFTS contract at Canadian Aviation Training Centre at Southport, Manitoba
- All Phase II and advanced jet Phase III pilot training at 2 Canadian Forces Flying Training School (2 CFFTS) at Moose Jaw as part of the NFTC contract
- Phase III Helicopter and Multi-Engine pilot training through the CFTS contract at 3 Canadian Forces Flying Training School (3 CFFTS) at Southport, Manitoba
- Phase IV fighter lead in training at Cold Lake, Alberta through NFTC
- Canadian Forces Air Navigation School at Winnipeg for Air Navigator training;
- Canadian Forces School of Aerospace Control Operations (CFSACO) at Cornwall for initial training of Aerospace Controller (AEC) and Aerospace Control Operators
- Canadian Forces School of Search and Rescue at Comox for SAR training
- Canadian Forces School of Survival and Aeromedical Training at Winnipeg for aircrew survival and aeromedical training
- Canadian Forces School of Aerospace Technology and Engineering (CFSATE) at Borden for Aeronautical Engineering (AERE) and 500 series air maintenance technical training
- Canadian Forces School of Meteorology (CFS Met) at Winnipeg
- Canadian Forces School of Aerospace Studies at Winnipeg (Basic & Advanced Aerospace Ops, Aerospace Systems, Basic & Advanced EW and Space Applications
- Air Command Professional Development Training Centre (ACPDTC) at Borden for Basic Military Qual and Air Environmental, Junior Leader Air Environmental, Primary Leadership qual, Sergeant Seminar, and Senior Air Supervisor courses
- Operational Flying Training located at Cold Lake (CF18), Greenwood (Aurora), Gagetown (Griffon), Shearwater (Sea King), Trenton (Hercules and Polaris) and North Bay (Air Weapons Control)
- Specialty qualification training course such as the Fighter Weapons Instructor Course (FWIC) and Fighter Electronic Warfare and Advanced Radar Course (FEWAR) at Cold Lake
- Flag series of exercises - Maple, Red, Green, Copper, and Blue Flag.

Annex C

Operational Test and Evaluation (OT&E)

The Aeronautical Engineering Test Establishment (AETE) at Cold Lake conducts Air Force Test & Evaluation (T&E). Operational Test and Evaluation takes place at:

- Fighter Operational Test and Evaluation Facility (FOTEF) at Cold Lake
- Maritime Proving and Evaluation Unit (MP&EU) at Greenwood
- Griffon OT&E facility at 403 Squadron at Gagetown
- Helicopter Operational Test and Evaluation Facility (HOTEF) at Shearwater
- Transport Operational Test and Evaluation Facility (TOTEF) at Trenton



Annex D

Air Force Wings

The infrastructure footprint of Canada's Air Force has been rationalized many times in recent years and reduced to 13 Wings across the country with Squadron level units as follows:

- **1 Wing,** Kingston – a Land Aviation HQ to support Regular Force Griffon Squadrons located at Gagetown (OTU), Petawawa, Valcartier, and Edmonton, and formed reserve squadrons at Montreal and Borden
- **3 Wing,** Bagotville (CF18 main operating base – 425 Tactical Fighter Squadron, 433 Tactical Fighter Squadron, 439 Combat Support Squadron, 3 Air Maintenance Squadron and 12 Radar Squadron)
- **4 Wing,** Cold Lake (CF18 main operating base - 410 Tactical Fighter (Operational Training) Squadron – Fighter Weapons Instructor Course (FWIC) and Fighter Electronic Warfare and Advanced Radar (FEWAR), 416 Tactical Fighter Squadron, 441 Tactical Fighter Squadron, 419 Tactical Fighter Training Squadron, 417 Combat Support Squadron, 42 Radar Squadron, 1 Air Maintenance Squadron and 10 Field Technical Training Squadron)
- **5 Wing,** Goose Bay (Allied Flying Training – 444 Combat Support Squadron, Royal Air Force Unit, Royal Netherlands Air Force, German Air Force Tactical Training Support Group)
- **8 Wing,** Trenton (AT/AAR main operating base, 424 Search and Rescue/Transport Squadron, 426 Training Squadron, 429 Transport Squadron, 436 Transport Squadron, 437 Transport/AAR Squadron - Polaris, 2 Air Movements Squadron, 8 Air Communications and Control Squadron, 8 Air Maintenance Squadron, Canadian Forces Aircrew Selection Centre and supporting 412 Transport Squadron in Ottawa)
- **9 Wing,** Gander (103 Search and Rescue Squadron, Airfield Engineering Flight, CFS Leitrim Detachment)
- **12 Wing,** Shearwater (Sea-King main operating base, 406 Maritime Operational Training Squadron, 423 Maritime Helicopter Squadron, 443 Maritime Helicopter Squadron located at Pat Bay, 12 Air Maintenance Squadron, Helicopter Operational Test and Evaluation Facility (HOTEF))
- **14 Wing,** Greenwood (Aurora main operating base, 404 Maritime Patrol and Training Squadron, 405 Maritime Patrol Squadron, 415 Maritime Patrol Squadron, 413 Transport and Rescue Squadron (Hercules), Maritime Proving and Evaluation Unit (MP&EU), 14 Air Maintenance Squadron, 14 Software Engineering Squadron)

- **15 Wing,** Moose Jaw (Flying Training Base – 2 Canadian Forces Flying Training School. 431 Air Demonstration Squadron Snowbirds))
- **16 Wing,** Borden (Air Force Schools Canadian Forces School of Aerospace Control Operations (CFSACO) located in Cornwall at the NAVCAN training facility, Canadian Forces School of Aerospace Technology and Engineering (CFSATE), Air Command Professional Development and Training Centre). The airfield at Borden has been designated as a Heritage Site
- **17 Wing,** Winnipeg (1 CAD/CANR HQ, 402 "City of Winnipeg" Squadron, 435 Transport and Rescue Squadron (with AAR capable aircraft), support to 440 Transport and Rescue Squadron based in Yellowknife, support to 3 Canadian Forces Flying Training School, 1 Air Movements Squadron, Canadian Forces School of Aerospace Studies (CFSAS), Canadian Force Air Navigation School (CFANS), Canadian Forces School of Survival and Aeromedical Training (CFSSAT) and Canadian Forces School of Meteorology (CFS Met))
- **19 Wing,** Comox (Aurora operating location, SAR main operating base – 407 Maritime Patrol Squadron, 442 Transport and Rescue Squadron, 19 Air Maintenance Squadron and Canadian Forces School of Search and Resuce CFSSAR))
- **22 Wing,** North Bay (CANR Sector Operations Center – 21 Aerospace Control and Warning Squadron, 51 Aerospace Control and Warning Operational Training Squadron and 722 Support Squadron (USAF))

Annex E

Air Reserves

Air Reserve units are currently located in

- **The NWT** - Yellowknife
- **British Columbia** - Comox (19 Wing Air Reserve Flight), Pat Bay (443 Maritime Helicopter Squadron), and Abbotsford (192 Airfield Engineer Flight)
- **Alberta** - Cold Lake (4 Wing Air Reserve Flight) and Edmonton (408 Tactical Helicopter Squadron)
- **Saskatchewan** - Moose Jaw (15 Wing Air Reserve Flight)
- **Manitoba** - Winnipeg (17 Wing Air Reserve Flight, 402 Squadron and 1 Canadian Air Division Headquarters Air Reserve Flight)
- **Ontario** - North Bay (22 Wing Air Reserve Flight), Petawawa (427 Tactical Helicopter Squadron), Borden (16 Wing Air Reserve Flight and 400 Tactical Helicopter Squadron), Kingston (1 Wing Headquarters), Trenton (8 Wing Air Reserve Flight), Ottawa (Air Reserve Flight Ottawa and positions within the air staff)
- **Quebec** - Valcartier (430 Tactical Helicopter Squadron), Bagotville (3 Wing Air Reserve Flight), and St. Hubert (438 Tactical Helicopter Squadron)
- **New Brunswick** - Gagetown (403 Helicopter Operational Training Squadron)
- **Nova Scotia** - Pictou (144 Airfield Engineering Flight), Greenwood (14 Wing Air Reserve Flight), Bridgewater (143 Airfield Engineering Flight and 14 Airfield Engineering Squadron), and Shearwater (12 Wing Air Reserve Flight)
- **Newfoundland and Labrador** - Gander (9 Wing Air Reserve Flight and 91 Airfield Engineering Flight), Torbay (Air Reserve Flight Torbay) and Goose Bay (5 Wing Air Reserve Flight)

Annex F

Post Cold War Air Force Evolution

1989 and 1990 Federal Budgets

Post Cold War budget cuts started with the 1989 Federal Budget. It announced the closure of some bases, a cut in military personnel and the cancellation of some equipment projects. Additional fiscal restraint measures were announced in the 1990 budget. Defence cuts over the two budgets totaled $3.4B.

1991 Statement on Defence Policy

In September 1991, the Statement on Defence Policy reaffirmed traditional defence commitments, but it also announced reductions that included the closure of CFB Baden in 1994 and Lahr in 1995 and a lowering of the overall personnel ceiling of the Canadian Forces from approximately 84,000 to 76,000.

1992 Canadian Defence Policy

The overall theme of the 1992 policy paper was one of fiscal constraint. It announced an additional $2.2B in cuts over five years, established a regular force personnel ceiling of 75,000 for FY 95/96 and the accelerated closure of Baden and Lahr by one year (It stated that the two fighter squadrons at Baden were being reduced to one fighter squadron of 24 aircraft in 1992 and that operations would cease in Europe by 1993).

The paper acknowledged the need to maintain a "minimum essential level of military capability" stating that "combat skills and fighting capabilities which, once lost, cannot be easily or quickly replaced" and discussed aims of maintaining:

a. "Four fighter squadrons (assigned an air defence role with a limited air-to-surface capability to provide support to maritime and land operations) and the capability to deploy two of the squadrons of CF 18s of 18 aircraft each, capable of assignment to multilateral contingency operations of the type carried out in the Gulf." worldwide;

b. One operational CF 18 training unit (20 aircraft) and one Fighter Lead-In Training unit (25 CF 5s);

c. Three composite squadrons for combat support, electronic warfare training, and coastal patrol;

d. Three maritime patrol squadrons and a training unit, and two maritime helicopter squadrons and a training unit to provide support to maritime forces;

e. Three tactical aviation squadrons, a multi-role squadron, a training unit and two reserve aviation wings for general purpose support of the land forces; and

f. One strategic transport, three tactical transport, one VIP transport, one refueling and four search and rescue squadrons."

1993 Special Joint Committee

In November 1993, the Prime Minister announced the initiation of a comprehensive review of Defence Policy. A Special Joint Committee on of the Senate and House of Commons was established to consult Canadians. Their report stated that defence spending had peaked at $12.26 billion in 1990-1991. It also stated that the Feb 1994 budget reductions in planned defence expenditures (totaling some $7 billion over the planning period 1994-1998) were in addition to the previously announced cuts of $14 billion since 1989 and that these cuts would result in a regular force of 66,700 by 1998. The committee believed that this represented "the minimum capability for the CF to play a meaningful role at home and abroad".

1994 White Paper on Defence

The 1994 Defence White Paper, among other things, contained a budgetary theme that persisted until the end of the century and beyond. It provided direction to; reduce personnel and resources committed to Department and Forces HQ functions by at least one-third by 1999; extend the life of equipment wherever cost-effective and prudent; and acquire new equipment "only for purposes considered essential to maintaining core capabilities of the CF".

Canada's fifth White Paper on Defence incorporated the majority of the findings of the 1993 Special Joint Committee, but added that "Cuts to the defence budget deeper than those envisioned by the Committee will be required to meet the Government's deficit reduction targets." A Regular Force personnel target of 60,000 was established in the paper. The paper added that the 1994 budget envisaged a level of spending on defence in the year 2000 that would be less than 60 per cent of that assumed in the 1987 White Paper. The paper went beyond the cuts recommended by the Special Joint Committee, but it did not address the committee's belief that their proposal represented the minimum capability for the CF to play a meaningful role at home and abroad.

The paper stated that the Canadian Forces would be able to deploy in support of the UN or NATO, or re-deploy from other multilateral operations, a joint task force headquarters and, as single units or in combination, one or more of the following:

a. "a naval task group (four combatants and a support ship) with appropriate maritime air support;

b. three separate battle groups or a brigade group (three infantry battalions, an armored regiment and an artillery regiment, with appropriate combat support and combat service support);

c. a wing of fighter aircraft with appropriate support; and,

d. one squadron of tactical transport aircraft".

Defence White Papers published since 1959 have traditionally discussed policy-based tasks and not specific aircraft fleet sizes. The 1994 White Paper was an exception. It contained direction to reduce the number of operational CF18s to between 48 and 60 as one of four ways of reducing expenditures on fighter forces and support by 25%.

1994 Federal Budget

Budget 94 reduced the DND budget by $3.6B over three years.

1995 Federal Budget and Program Review I

Budget 95, the next spring, confirmed a 60 aircraft operational CF18 fleet size as the number to retain for reducing the overall cost of maintaining a fighter capability by 25%. Costs were reduced by 31% ($312M) through Project Genesis ($230M) and subsequent Air Force PO&M initiatives ($71M). Program Review I (PR I) resulted in a $3B reduction to DND over four years.

1996 Federal Budget and Program Review II

Program Review II (PR II) resulted in unforeseen baseline cuts to DND ($200M in FY97/98). increasing to $450M in FY98/99.

Project Genesis

The Commander Air Command and Senior ADM (Mat) initiated Project Genesis in February 1995. Its initial aim was to address the 1994 White Paper direction to reduce fighter force and support PO&M by at least 25 per cent. The initiative was later applied across the Air Force - the aim being to initiate massive change activity within the Air Force as a solution to rapidly shrinking fiscal and personnel resources. Genesis aimed to do so by reducing costs as much as possible by 2001 while minimally affecting operational capabilities.

The March 1996 Project Genesis report concluded that the cost of generating and sustaining Canada's Air Force in FY 93/94 (the Project Genesis baseline) was $2.38B PO&M and an additional $885M as an average capital expenditure based on a 15-year envelope. The PO&M breakdown follows:

a. Fighter Force (122 CF18s and CF5s) - $1.002B;
b. Air Transport Force - $503.4M;
c. Maritime Air Forces - $489.4M
d. Land Aviation (Twin Huey and Kiowa) - $96.6M;
e. Chief of Staff Personnel and Training - $250.9M;
f. Reserves - $17.4M; and
g. Departmental Overhead - $20.3M

Staff from Air Command, NDHQ (most notably D Cost S staff) and the Groups expended considerable effort in compiling Air Force costs in conjunction with the 1994 Program Review and White Paper. DGAEPM and Air Command Comptroller staffs conducted a concurrent costing exercise in preparation for Project Genesis. The costing structure and data derived from both efforts and from other projects, such as Operation Excelerate, contributed to the Air Force costing baseline. Project Genesis delivered substantial savings to the Department. Fighter force costs were reduced by 25% and overall Air Force costs were reduced by $456M from the FY93/94 baseline in just two years (a 20 per cent overall reduction). A 2002 validation of the fighter force cost reductions concluded that fighter force costs had been decreased by 31% by FY98/99.

Air Force Command and Control Re-engineering Team (AFCCRT)

The Air Force Command and Control Reengineering Team (AFCCRT) was created to develop the strategic-level staff organization for the Chief of the Air Staff (CAS) and a single Air Force Operational Level Headquarters (responsible for the operational-level functions from Air Command Headquarters and the four Group Headquarters as well as the Canadian NORAD Region Headquarters). It aimed to realize a savings of up to 569 positions out of the 1,138 regular force and civilian FTE positions (includes 672 in Air Command HQ and 59 in DGAD) involved in Air Force headquarters functions above the tactical level as of December 1995.

On 31 July 1997 Air Command headquarters and its subordinate groups were disbanded. They were replaced on 1 August 1997 by a strategic level air staff that was formed at NDHQ and an operational level staff, called 1 Canadian Air Division (CAD) / Canadian NORAD Region (CANR) headquarters that was formed in Winnipeg. The Commander of Air Command moved from Winnipeg to Ottawa and assumed additional responsibility as the Chief of the Air Staff (CAS).

AFCCRT was connected to the larger DND Management Command and Control Reengineering Team (MCCRT) initiative that was started in late 1994 to manage the personnel reductions directed by the 1994 White Paper as well as the HQ structural changes that would be necessary. The 30 month MCCRT initiative included work in areas such as defence policy development, resource management, business planning, performance measurement, delegation of authority, alternative service delivery, information management strategy, accommodation needs, administrative support, communication needs and cultural evolution.

Flight Plan 97

Flight Plan 97 was a consolidation of change initiatives underway in Air Command. There were five main elements of the plan (a dramatic reduction in headquarters personnel, infrastructure and fleet rationalization development of a globally deployable contingency support capability and an exploration of new approaches to training). Under the plan, fleet rationalization and partnering with industry permitted a dedicated Air Force to cope with 90% of the operational tempo of 1989 with 45% (10,160) fewer military personnel. Initiatives underway aimed to reduce Air Force costs by a full 25% by 2001 (including the 20% realized by Project Genesis).

1999 Air Force Baseline

Defence policy and budget documents subsequent to 1994 stated that to ensure operational capabilities would not deteriorate as a result of cuts to defence budgets, personnel reductions were necessary in order to continue to fund the Capital Equipment Modernization Program.

During the period 1989 to 1999, the numbers of Regular Force personnel assigned to the combatant CCs (CC1, CC2 and CC3) decreased from 56,800 to 42,900 (a reduction of 13,990 personnel). Air Command regular force personnel strength was reduced from 24,113 to 13,312 (a reduction of 10,801 personnel). This 45% reduction in Air Force personnel represented nearly 80% of the total CF combatant CC reduction. Civilian FTEs were reduced from 6980 to 2205. The nearly 69% reduction accounted for nearly 55% of combatant CC CF reduction. As well, the number of CC3 headquarters was reduced from 5 to 2.

Prior to FY 93/94, National Procurement and operating budget expenditures were not broken out and tracked by environments. In FY 93/94 the total NP budget was $1,448M and $820.9M (56.7%) was allocated to CC3. In FY 98/99 the total NP budget was $1,374M and $636.2M (46.3 %) was allocated to CC3. The NP apportioned account reductions for CC3 between FY 93/94 ($820.9M – DGAEPM allocation was $712.9M excluding ammo, COLOG and pubs) and FY 98/99 ($636.2M – DGAEPM allocation was $570.9M excluding ammo, COLOG and pubs) accounted for 46% of the combatant CC CF reduction. The CC3 operating budget was reduced from $586.2M in FY 93/94 to $421.3M in FY 98/99 (33%).

Placed in context, the 1999 Air Force personnel establishment was the lowest subsequent to the Second World War. Over the 10-year period (1989 to 1999) the primary combat power capability of the Air Force was reduced from 7 fighter squadrons to 4 and the total number of operational CF18s was reduced from 96 to 60. The number of Auroras Long Range Patrol aircraft and Sea King helicopters supporting the navy was maintained at 18 and 32 respectively. The land aviation fleets supporting the army evolved into a single fleet of 89 Griffon helicopters that were delivered between 1994 and 1998.

Capability Renewal

After nearly a decade of significant cuts, the strategic capital pressures in the Department were not abating. A strategic Air Force retreat was held in June 1998 that focused on Air Force capability renewal and modernization. The retreat resulted in direction to establish working groups to develop transitional force structure proposals aimed at reducing operations and thereby freeing up money for the modernization of capital. End-state force structures were also to be identified.

Transitional force structure proposals were developed but not implemented. Instead, tiered readiness postures were proposed for each aircraft fleet to further reduced Air Force expenditures and free up money for modernization. End state force structures emanating from this activity were briefed to the MND in March 1999. Proposed changes were:

a. A further decrease in the number of operational CF18s from 60 to 48 (overall fleet size reduction from 100 to 80);

b. A decrease in the number of Aurora from 18 to 16 and the elimination of the Arcturus training variant;

c. A decrease in the number of maritime helicopters from 32 Sea King to 22 new Maritime Helicopters;

d. A decrease in the Griffon fleet from 99 to 80;

e. Elimination of the T33 and Challenger fleets dedicated to EW and combat support;

f. A study on the future of the Snowbirds.

2000 Force Structure Exercise (FSX)

The first federal budget of the 21st Century did not provide much capital equipment relief to DND. Force Structure Exercise (FSX) was an Air Force exercise conducted in May 2000 that examined potential reductions in Air Force structure and activities to increase funds available for modernization and the acquisition of new capabilities. In doing so, study groups were cognizant of the requirement to keep the Air Force relevant and combat capable over the next two decades. Gaps were identified between capability required (stemming from policy) and capability available (what was affordable). The study groups recommended the following minimum capability:

a. 48 operational CF18s (fleet size of 80);

b. 16 Aurora;

c. 28 Sea King;

d. 27 Hercules and 5 AAR capable Hercules;

e. 5 Polaris air transport (2 AAR capable);

f. 75 Griffon helicopters (including 10 for Air Force combat support);

g. 15 Cormorant SAR helicopters;

h. 6 Challengers for passenger airlift;

i. 17 Tutor for Snowbirds;

j. 6 Dash 8 for nav training;

k. 24 Harvard II for pilot training;

l. 18 Hawk for jet training;

m. 4 Twin Otter for northern utility support.

The recommendations concerning the combat capable fleets were predicated on having high fidelity simulation capability in place before the reductions were made.

Post FSX

The CAS directed six additional studies subsequent to FSX. They were:

a. Air Force Infrastructure and Footprint – aim to reduce Air Force holdings by 10%;

b. Combat Support Squadron Study - aim to eliminate combat support aircraft along with the majority of assigned tasks (electronic warfare training, target towing, coastal patrol, courier, VIP support, aeromedical evacuation, secondary SAR support);

c. SAR study – aim to quantify what represents an essential minimum level of service;

d. Maritime Helicopter Basing Study – aim to establish an appropriate basing concept for the new MH;

e. Operational Capability Alignment – aim to identify the cross functional/cross capability impacts of FSX; and

f. Air Reserve Study – aim to establish appropriate roles and readiness levels.

Annex G

Outside of Canada Positions

NORAD

There are currently 288 Canadian positions established Outside Canada (OUTCAN) either directly employed within NORAD or in other organizations (such as US Space Command and AF Space Command) that provide support to NORAD for it to effectively execute its aerospace warning and aerospace control missions for North America. Air Force personnel occupy 268 of these positions. Naval and Army personnel occupy 10 positions each in the combined and joint establishment of NORAD. Air Force personnel are currently employed in:

- **Headquarters -** NORAD headquarters
- **Cheyenne Mountain Operations Centre** (CMOC);
- **Regions -** Alaskan NORAD Region (ANR), and Continental US NORAD Region (CONR)
- **Sectors -** CONR North East Air Defence Sector (NEADS), South East Air Defence Sector (SEADS), and CONR Western Air Defence Sector (WADS);
- NORAD Software Support Facility (NSSF);
- NORAD AWACS at Tinker Air Force Base (AFB);
- **Sensor sites -** BMEWS sites at Clear and Thule, PAVE PAWS sites at Beale and Cape Cod, DSP site at Buckley; and positions at 10 SWS Cavalier
- **Other -** MIT/Lincoln Labs, JNIC Schriever, BMDO LO Washington, and Peterson AFB.

Space Positions

- U.S. Space Command Headquarters;
- Air Force Space Command Headquarters; and
- COMSPACEAF and Vandenburg.

Prior to 2001, there was a single U.S. commander responsible for three U.S. commands – North American Aerospace Defence Command (NORAD), United States Space Command (USSPACECOM) and Air Force Space Command (AFSPACECOM). In April 2001, AFSPACECOM was organizationally split from the other two commands and a separate commander assigned to command it. In 2002, NORAD and USSPACECOM were organizationally split. USSPACECOM was organizationally combined with US Strategic Command (USSTRATCOM) and the Commander of NORAD was also assigned responsibility for the newly formed US Northern Command (USNORTHCOM). The impact of all these U.S. command changes on Canadian NORAD OUTCAN positions has yet to be determined.

Canada-U.S. Bi-National Planning Group

Canada and the United States agreed to establish a Bi-national Planning Group (BPG) to significantly enhance Canada-U.S. cooperation in maritime, land and civil support for the prevention or mitigation of terrorist or other attacks and natural disasters. The BPG will be located in Colorado Springs. The Canadian Contingent of the BPG (CCBPG) will be formed with a two-year mandate to investigate options for Canadian participation in an expanded bi-national homeland security structure. Two main areas will be examined – incorporation of the maritime surveillance picture into NORAD (Cheyenne Mountain) and plans to address support to civil authorities in areas such as consequence management. NORAD, as a bi-national organization already involved in homeland security from an aerospace perspective, will contribute to the process.

NATO OUTCAN positions

There are currently 350 Canadian positions established Outside Canada (OUTCAN) either directly employed within NATO or in other organizations (such as Multi-Service Electronic Support Group - Land (MSEW Sup Gp) and European NATO Joint Jet Pilot Training (ENJPPT)) that provide support to NATO. Air Force personnel occupy 164 of these positions. Air Force personnel, in addition to Debert, NS and Ottawa are currently employed in the following countries:

- **Belgium** - Canadian Representative Military Cmte in Permanent Session (CANMILREP) in Brussels, NATO Military Staff in Evere, Supreme HQ Allied Powers in Europe (SHAPE) in Casteau, Canadian Military Representative SHAPE (CANMILREP SHAPE) in Casteau, Canadian Component NATO Airborne Early Warning Force (CC-NAEWF) in Casteau
- **Germany** - CC-NAEWF in Geilenkirchen (94 of the 114 positions), Germany, Central Group HQ in Heidelberg, HQ Allied Air Forces in Northern Europe (HQ AAF NE) in Ramstein, Canadian Element Reaction Force – Air (CC RE(A)) in Kalkar, NATO School SHAPE in Oberammergau
- **United States** - Canadian Component Supreme Allied Command Atlantic (CC SACLANT) in Norfolk, VA, Canadian Component HQ West Atlantic (CC HQ WESTLANT) in Norfolk, VA, Wichita Falls
- **Italy** - HQ Allied Air Forces in Southern Europe (HQ AAF SE) in Naples, NATO Defence College in Rome, Tactical Leadership Programme (TAC LDR PROG) in Florennes
- **Netherlands** - HQ Allied Forces in Central Europe Support (HQ AFCENT SPT) in Brunssum,
- **Norway** - Principle Sub Command in Jatta,

Annex H

Major Aircraft fleet details

CF-18 Fatigue Life Management and Estimated Life Expectancy

Fatigue Life Expenditure Index (FLEI) management is a significant issue for this high performance combat aircraft, one unique among current Air Force fleets. The Estimated Life Expectancy (ELE) of the CF-18 fleet was initially established at 2003 based on a FLEI of 0.667. Implementation of a Fatigue Life Management Program (FLMP) in 1988 had the effect of extending the ELE from 2003 to 2010 by significantly reducing the accumulation of fatigue on the aircraft fleet. Canada became involved in an International Follow-On Structural Test (IFOST) program with Australia in 1989 to determine the safe and economic structural life of the CF-18 fleet. Testing started in 1995 and will continue until 2005. Failures of a critical nature discovered during testing in 1997 resulted in a reduction in the FLEI airworthiness safety threshold from 0.667 to 0.56. An economic threshold of 0.52 FLEI was subsequently established as the point prior to which structural modifications must be incorporated if the aircraft is to remain flying. Structural modifications will be undertaken through the Aircraft Life Extension (ALEX) and Centre Barrel Replacement (CBR) programs. ALEX consists of three Control Point (CP) programs aimed at progressively increasing the FLEI airworthiness thresholds to 0.64 (CP1), 0.73 (CP2) and then 1.0 (CP3). A FLEI of 1.0 equates to an ELE of 2017.

Aircraft Fleet Size

When the CF-18 entered service, there were 96 operational aircraft from within a total fleet size of 138. The 1994 White Paper gave direction to reduce the CF-18 fleet size to between 48 and 60 operational fighters. Budget 95, the next spring, confirmed 60 to be the minimum number provided White Paper direction to reduce fighter operating costs by 25% were met. Reductions of 25% (from the FY 93/94 baseline) were achieved through Operation Genesis in two years. A 2002 validation effort confirmed overall reductions of 31% by FY 98/99. In 1997, the Synopsis Sheet Identification (SS(ID)) for CF-18 modernization called for the modernization of up to 100 CF-18s (60 identified as 'operational' aircraft). In June 2000, DND issued direction to reduce the scope of modernization plans to 80 aircraft.

Issues

The intended reduction in operational aircraft from 60 to 48 will have operational implications that are currently being examined within the context of operations in the post 9/11 security environment. For example, recent domestic operations have shown that it takes eight aircraft to maintain a 24 hour-a-day airborne protection over a single geographical location such as a city for an extended period of time. This means that approximately four continuous airborne CAPs could be generated from 34 MR aircraft.

The reduction in fleet size from 121 to 80 will also require careful monitoring. In the past, the entire fleet was available for fatigue life management and aircraft could be cycled from operational to non-operational status as a means of spreading fatigue accumulation over the entire fleet. Once non-modernized aircraft are disposed of, this will no longer be possible.

The ability of fighter squadrons to train and upgrade pilots to Combat Ready (CR) element lead, section lead and mass attack lead status is directly linked to the number of experienced pilots available and the squadron's ability to generate the sorties needed to accomplish required training. Fleet YFR has dropped from 28,045 hours in FY93/94 to a planned 17,800 hours for FY02/03. More importantly, YFR assigned to individual pilots has progressively dropped from approximately 240 hours in the 1980s to 178 today. Training at very low-levels has been essentially terminated and the number of CR pilots was reduced from 92 to 68 in the summer of 2000 to live within budgetary allocations. Current operational taskings and concerns regarding 'critical mass' now require a reassessment of YFR allocations and personnel establishments, something being undertaken as part of Project Transform.

Aurora Estimated Life Expectancy

The Service Life Assessment Program (SLAP) is a multinational program led by the United States Navy, intended to evaluate the life of the P-3 (in Canada's case, CP-140 Aurora) through a series of fatigue tests and structural teardowns. The Canadian Forces, Royal Australian Air Force and Royal Netherlands Air Force are partners with the U.S. in SLAP. Based on SLAP data to date, an ELE of 2015 is considered achievable (although this will require replacement of several large parts such as wing skins and spars). The Aurora Service Life Extension Project (SLEP) is being developed based on information gained from SLAP with the intention of extending the CP-140 ELE to 2025.

Aurora Issues

The Aurora fleet has been subject to YFR decreases and reduced crew manning levels over the past several years. FSX directed a reduction from the current 15 operational line crews and six executive CP-140 crews (based on five line and two executive crews on each of three operational squadrons) to 14 line crews and four executive crews. Each CP-140 crew comprises 10 personnel (two pilots, one flight engineer, one tactical navigator, one navigator-communicator, two acoustics operators and three non-acoustics operators for radar, Electronic Support Measures (ESM), Electro-Optical (EO) sensors, Magnetic Anomaly Detector (MAD) and on-board armament).

CP-140 fleet YFR has dropped from 19,200 hours in FY93/94 to 10,000 hours for FY02/03. A further fleet YFR reduction to 8000 hours by FY05/06 is planned, coincident with achieving full operational capability with a high fidelity Flight Deck Simulator. Reductions in CP-140 YFR have resulted in a dramatic increase in the time required to upgrade Aurora pilots to Maritime Patrol Crew Commander (MPCC) and the time required to develop other crewmembers has also increased.

Project Transform will address the issues discussed above, including crew mix and structure, number of operational squadrons, manning requirements for the modernized Aurora and YFR. Due consideration will be given to the impact of advanced simulation technology being introduced as well as the number of aircraft being removed for modernization.

Sea King Estimated Life Expectancy

The ELE of the Sea King has been extended many times, most recently to 2005. This followed replacement of a center section and the main gearbox as well as upgrades to the engine and the addition of a standby attitude indicator. These measures ensure the aircraft remains airworthy and safe to fly. A further ELE extension beyond 2005 is being considered.

Sea King Issues

The force structure of 29 Sea Kings is currently resourced to generate nine Helicopter Air Detachments (HELAIRDETS) to support the Navy. A CH-124 crew comprises a Pilot, Co-Pilot, Tactical Coordinator and Sensor Operator. A typical HELAIRDET embarked on a Halifax Class Frigate (FFH) is comprised of two flight crews and 11 maintenance personnel for a total of 19 people. Larger detachments can be embarked on board Iroquois Class Destroyers (DDH) comprising three crews and 18 maintenance personnel for a total of 30 personnel. Three crews and 35 maintenance personnel (providing some second-line maintenance repair capability for the Sea King) can be accommodated onboard Auxiliary Oil Replenishment (AOR) ships for a total of 46 people. Personnel attrition in the MH community has reduced the Air Force's ability to generate this level of capability. To meet the nine-HELAIRDET commitment (and go beyond it) extraordinary measures must be undertaken by MH personnel. This challenge is compounded by the fact that when a MH detachment was established at Pat Bay on the West Coast, insufficient spares, test equipment and simulators to effectively operate from two locations were available.

Information obtained from a Maritime Helicopter Functional Organization and Establishment (FOE) study will be consolidated into phase II of the Maritime Helicopter Project Transform report. Phase I of the report will concern itself with force generation capacity assessment issues related to the Sea King.

Griffon Estimated Life Expectancy

An assessment will be made later in the ACF time period to determine if the 2020 ELE can be safely and economically extended.

Griffon Issues

The Griffon is one of the newest aircraft in the Air Force and no significant near term modernization projects are foreseen (beyond ERSTA). A yet to be defined mid-life update may be required in the post 2010 time period. Requirements emanating from the land aviation role review being undertaken within the context of the "Army of Tomorrow" development will need to be addressed before any mid-life upgrade is contemplated.

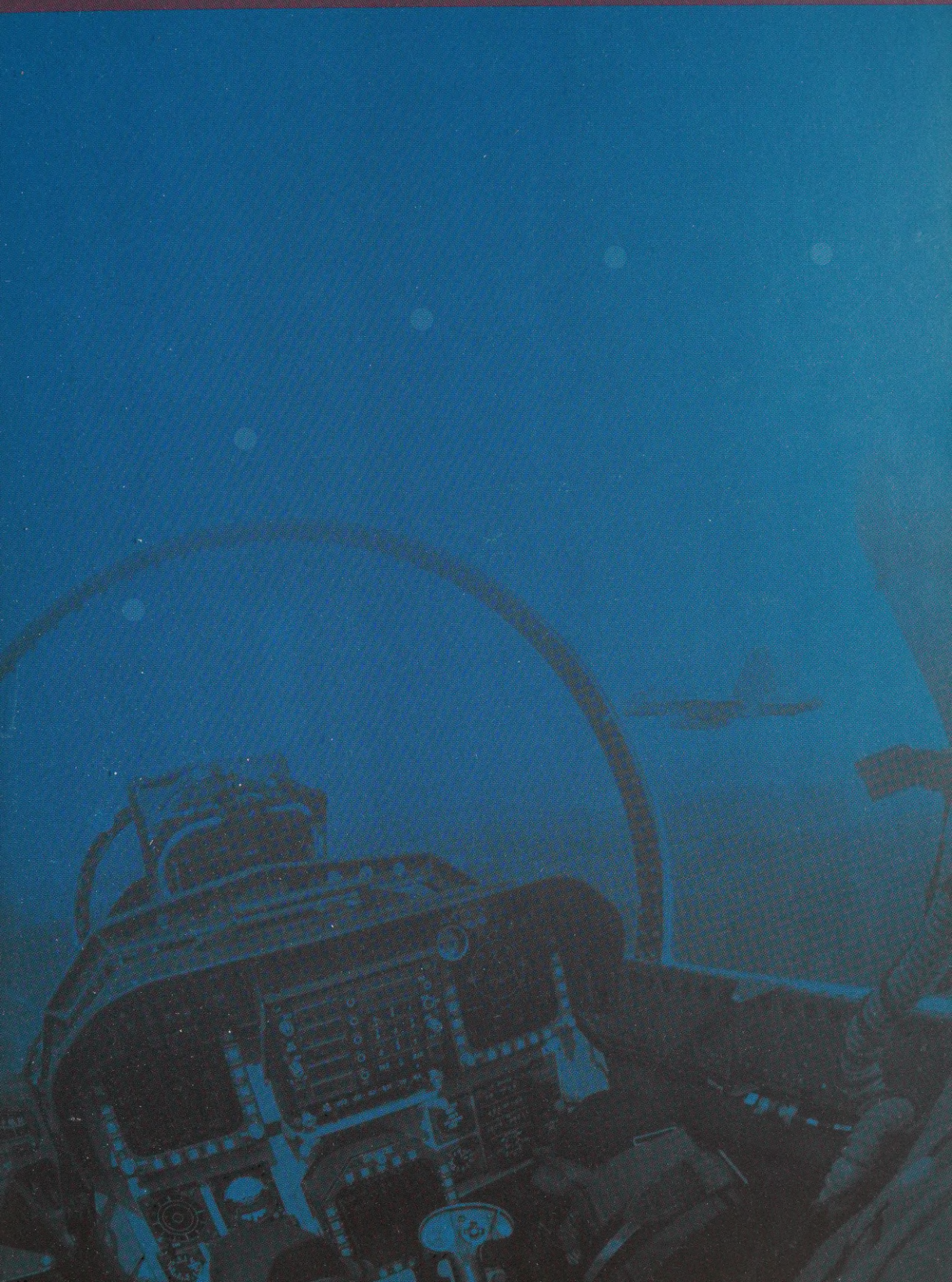
Airlift Fleet Estimated Life Expectancy

The Polaris fleet has an ELE of 2025 for planning purposes, however this is not based on structural limitations of the aircraft (which could theoretically be operated out to the 2050 time frame based on current flying activity). The following repairs/upgrades are underway or planned for the Polaris fleet:

- The current power plants are unsupportable and are being upgraded. The upgrade should be completed by FY 2008/09; and
- A structural/flight control inspection will be necessary in the aircraft's 20th year of service (FY 2006/07).

The CC-130 Hercules fleet currently consists of: 19 E models acquired between 1964 and 1968 (a total of 24 were acquired but five were lost in accidents); two H models acquired in 1975 (a total of five were acquired but three were lost in accidents); four H models acquired between 1985 and 1986; five H models acquired in 1991; and two H-30 'stretched Hercules' acquired in 1997. The ELE of the Hercules E model fleet varies. Three of the early E models have an ELE of less than 2010 while the ELEs of the other 16 are between 2010 and 2020. The H models have ELEs beyond 2020. Work is ongoing to refine these projections. The Hercules Aircraft Wiring and Structural Refurbishment (HAWSR) is a pre-emptive maintenance program to upgrade critical components identified as needing replacement to allow E model aircraft to operate safely until their ELE of 2010 and slightly beyond if necessary. A life extension and replacement study was conducted to determine the safe and economic life of the Hercules fleet and whether to replace or life-extend the high fatigue/older Hercules aircraft (mainly the E models). The conclusion was that, although a life extension is possible, the risk is quite high and replacement is the recommended option.






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